



# Minimizing Penalties For Industrial Sector By Using Automatic Power Factor Compensation (APFC) Unit

Mrs. Manisha S.Shingote, Pankaj D Kekane, Sandip E Bangar, Akash A Nile, Pranjal S Jadhav  
Department Of Electrical Engineering  
Sir Visveswaraya Institute Of Technology, Nashik, Maharastra-422103

**Abstract:** This project is mainly proposed for reducing the power loss in industries by using power factor compensation through a number of shunt capacitors. Power factor is defined as the ratio of real power to apparent power. By increase in reactive power increases the apparent power so the power factor decreases. By having low power factor the industry needs more energy to meet its demand hence efficiency decreases.

In this system, the output from step down transformer are fed into ZCD which converts sinusoidal waveform into square waveform to be used by microcontroller. Op-amp is used as a comparator for the ZCD circuit. Microcontroller displays the power loss due to inductive load on the LCD. This process is continuously actuate until the power loss would be zero by using relays which is used to bring the shunt capacitors into load circuit.

**Keywords** - Power factor, Industries, Microcontroller, ZCD, Shunt Capacitors, Op-Amp, Transformer, APFC

## I. Introduction

In Industrial Sector various apparatus are used to fulfill the goals of organization which helps to improve the efficiency of particular organizations. The apparatus includes static and rotating machineries having inductive load lead to raise reactive power i.e. motor, transformers. Reactive power is necessary power for energy storage devices like capacitor and inductor but excessive reactive power in circuit lead to power loss due to this power factor drops down. To overcome the loss establishment of APFC unit will be the key factor for industries. The APFC unit consists of microcontroller which is programmed to automatically vary the loss and correct the power factor.

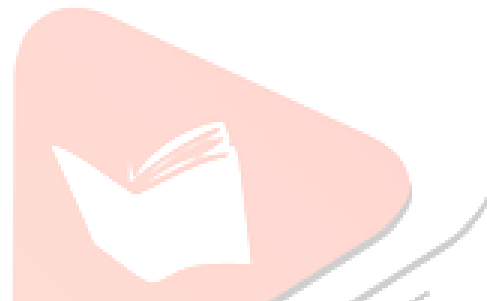
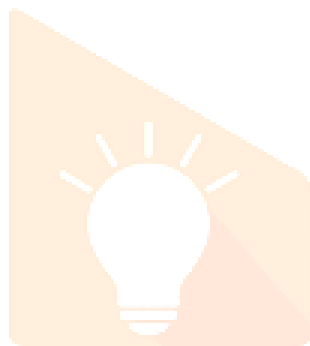
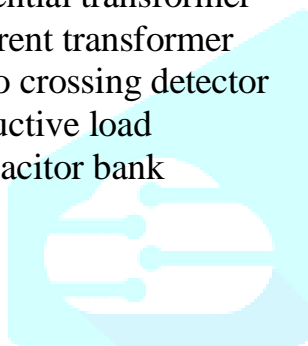
## II. APFC Device

Automatic power factor correction device is developed based on a microcontroller IC 8051. The voltage and current sample is converted into a square wave using a zero cross detector. The voltage and current sample signals are feed to the microcontroller at INT0 and INT1 and the difference between the arrivals of waveform indicate the phase angle difference.

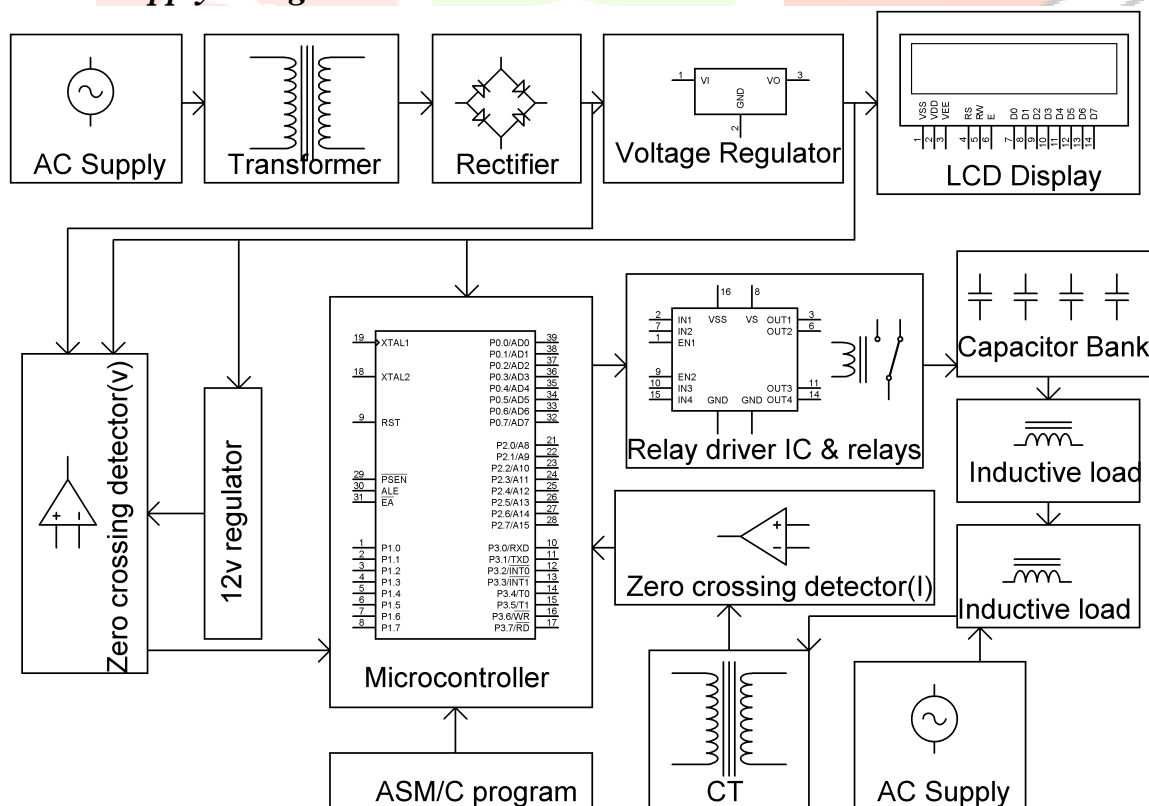
The difference is measured with high accuracy by using internal timer. This time value is calibrated and the phase angle and the corresponding power factor is also calculated. This value is displayed in the LCD modules after converting suitably displayed in the LCD modules after converting suitably. The capacitor banks are switched as per the calibration in steps.

## III. Components Required:

- 1) Auxiliary power supply
- 2) LCD display
- 3) Microcontroller(8051)
- 4) Potential transformer
- 5) Current transformer
- 6) Zero crossing detector
- 7) Inductive load
- 8) Capacitor bank



### Power Supply Design -



Block diagram : APFC Unit

#### IV. Advantages

- 1) Advantages of improved power factor
- 2) Better utilization of electrical machines
- 3) Better utilization of electrical lines
- 4) Reduction of losses
- 5) Decreased monthly energy cost
- 6) Efficient electrical system
- 7) Overloading is avoided
- 8) Efficiency of supply system and apparatus increases

#### V. Disadvantages

- 1) They have short life span ranging from 7 to 10 years
- 2) They get damaged easily if the voltage exceeds the rated value
- 3) Once the capacitors get damaged, their repair is uneconomical

#### VI. Applications

- 1) To improve power factor of inductive load such as induction motors
- 2) A high power factor is generally desirable in a transmission system to reduce transmission losses and improve voltage
- 3) It provides good voltage regulation and can be used at substation

#### VII. Conclusion

It can be concluded that power factor correction technique can be applied to the industries, power systems and also house hold to make them stable and due to that the system becomes stable and efficiency of the systems as well as the apparatus increases. When the detected power absorbed by the load is greater than the compensator rating, the power factor will not be corrected to unity but certainly, will be improved and the apparent power supplied by the AC supply will be reduced. They achieve better power quality by reducing the apparent power drawn from the AC supply and minimizing the power transmission losses. Hence the efficiency of the systems as well as the apparatus increases.

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