

PAPER POWER FACTOR IMPROVEMENT USING ARM 11 MICROCONTROLLER TITLE

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Abstract- The aim of paper is to implement efficient system which remove unwanted effect of reactive load to improve power factor. This is simple and effective technology for used to measure power factor of inductive load using Arm 11 microcontroller. The system is usable in various areas like domestic and industrial. The inductive type load gives low power factor also home appliances has low power factor so there is need of power factor improvement. The system has capability to sense voltage and current by potential and current transformer and using proper algorithm capacitor bank is switch on to remove unwanted effect of reactive power to manage power factor. The power factor of an inductive load shown on LCD display.

Keywords— Power factor, Reactive Power, KVA

I. INTRODUCTION

The appliance uses the electricity for various type of load. The inductive load having a lagging power factor, due to this low power factor the power losses were increases in the power system. The capacitor plays important role in compensating the reactive power. This improvement in power factor near unity helps to avoid the heavy penalties and also reduces electricity bill of consumer. The industrial and power system having inductive type of loads gives rise lagging current which decreases the power factor of the system.

II. POWER FACTOR

The apparent power (kVA) used in an electrical system by an industrial facility has two components productive power which produces work. Reactive power (kvar) which generates the magnetic fields required in inductive electrical equipment. The ratio of Productive Power (kW) to Total Power (kVA) is called the Power Factor.

$$PF = \frac{ActivePower}{ApprantPower}$$

III. METHODS OF POWER FACTOR IMPROVEMENT

1. Synchronous Condenser
2. Static capacitor
3. Phase advancer

1. Synchronous Condenser

When a Synchronous motor operates at No-Load and over-excited then it's called a synchronous Condenser. Whenever a Synchronous motor is over-excited then it provides leading current and works like a capacitor. When a synchronous condenser is connected across supply voltage (in parallel) then it draws leading current and partially eliminates the re-active component and this way, power factor is improved. Generally, synchronous condenser is used to improve the power factor in large industries [2].

2. Static capacitor

We know that most of the industries and power system loads are inductive that take lagging current which decrease the system power factor. For Power factor improvement purpose, Static capacitors are connected in parallel with those devices which work on low power factor.

These static capacitors provide leading current which neutralize (totally or approximately) the lagging inductive component of load current (i.e. leading component neutralize or eliminate the lagging component of load current) thus power factor of the load circuit is improved [8]. These capacitors are installed in Vicinity of large inductive load e.g. Induction motors and transformers etc., and improve the load circuit power factor to improve the system or devise efficiency. Power Factor improvement by static capacitor phase advancer and synchronous-condenser

3. Phase advancer

Phase advancer is a simple AC exciter which is connected on the main shaft of the motor and operates with the motor's rotor circuit for power factor improvement. Phase advancer is used to improve the power factor of induction motor in industries. As the stator windings of induction motor takes lagging current 90° out of phase with Voltage, therefore the power factor of induction motor is low. If the exciting ampere-turns are excited by external AC source, then there would be no effect of exciting current on stator windings. Therefore the power factor of induction motor will be improved. This process is done by Phase advancer [8].

IV. BLOCK DIAGRAM

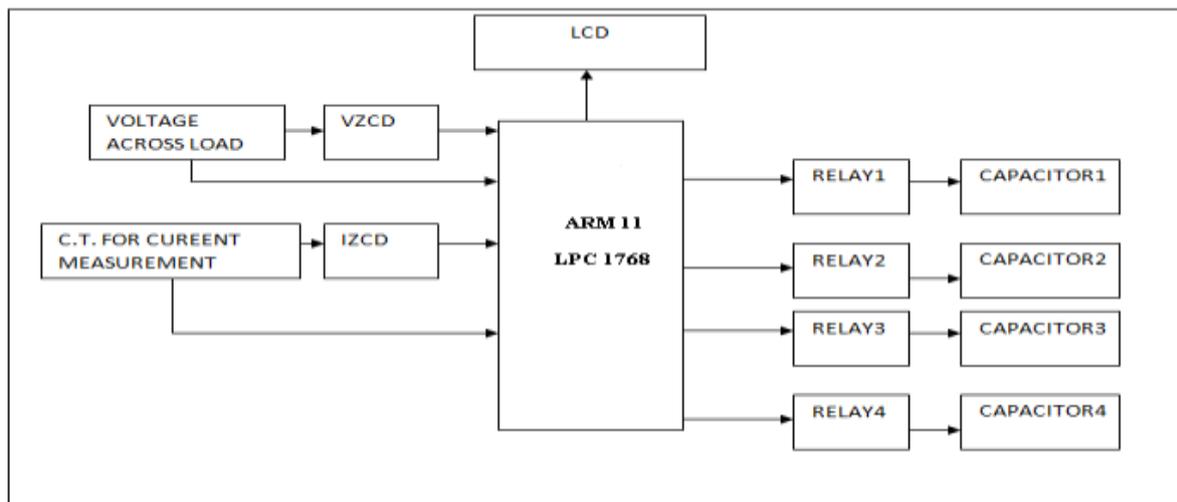


Fig.1. Block diagram of Am 11 microcontroller based power factor improvement system

The system aim is to build a simple, compact and energy-efficient system for automatic power factor monitoring and control. It consist of input detecting section, power factor improvement Arm 11 LPC 1768 based microcontroller kit along with a zero crossing detector circuit and a relay driver circuit & capacitor bank. The Current transformer and potential transformer are used for taking real time current and potential data of load. It is fed into the ARM 11 microcontroller via a zero crossing detector built using OP-07 Operational Amplifier. From the directly received phase data, microcontroller calculates the phase difference and gives the power factor of the system. It is displayed on an LCD.

V. SYSTEM HARDWARE

A. Current transformer and potential Transformer

A transformer is a power converter that transfers electrical energy from one circuit to another through inductively coupled conductors the transformer's coils. A step down transformer of 230V to 6V is used as potential transformer. PT gives 6V output for corresponding motor.

The Current Transformer is connected in series with inductive motor. The current transformer used is down current in required range. The burden register is connected secondary of current transformer which typically gives 2.5 V Output.

B.Zero Crossing Detectors:

The Output from potential transformer connected in parallel with motor and current transformer connected in series with load gives rise voltage and current signal of motor. This voltage

and current signal of inductive load is fed to voltage zero crossing detectors made of OP-07(VZCD) and current zero crossing detectors made of OP-07(IZCD).

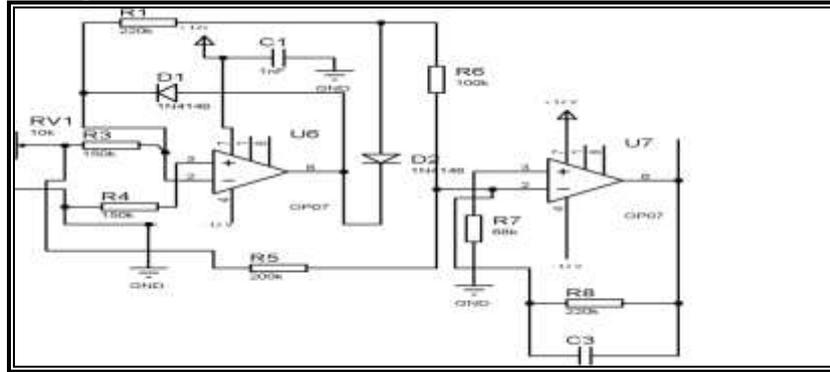


Fig.2. Op 07- Zero Crossing Detector circuit

C. Relay and capacitor bank:

Depending upon lagging power factor due to zero crossing of voltage and current signal of load .Arm 11 LPC 1768 Microcontroller switches on or off capacitor bank through switching relays. The power factor is display on LCD for given motor.

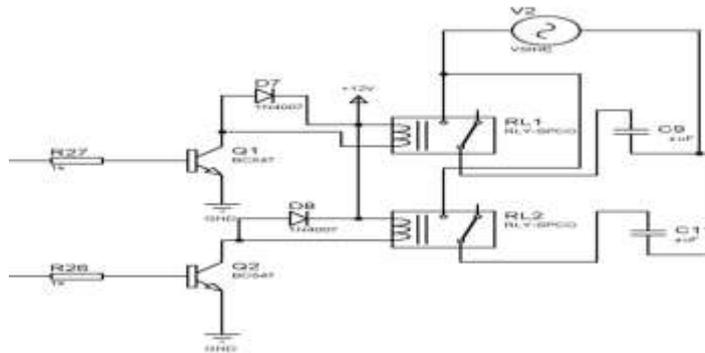


Fig3. Relay interfacing circuit

VI. LOW CHART

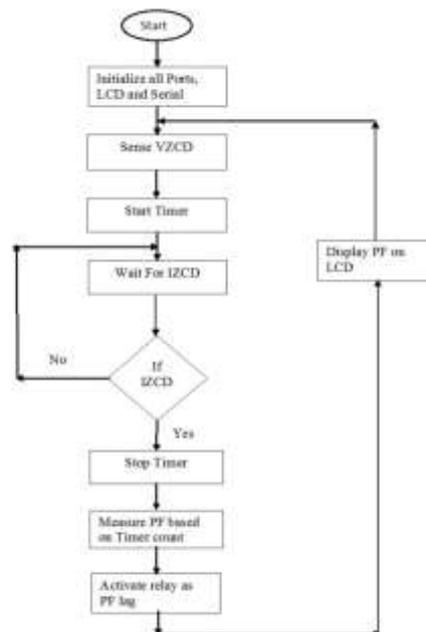


Fig.4 system flow chart

VII. RESULT

Table I : Observation Table Before power factor Improvement

Load	Power Factor
Exhaust fan	0.676
Table Fan	0.751

Table II : Observation Table After power factor Improvement

Load	Power Factor
Exhaust Fan	0.921
Table Fan	0.990

VIII. CONCLUSION

The Paper gives improved solution for improvement of power factor of motor by simple way. The static capacitors are used to give improved power factor in industries and in home appliances. The system calculate power factor based on algorithm then uses capacitors when power factor is low otherwise it cutoff from line because switching is done automatically [1]. It gives improved power factor as well as increases capacitor life.

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