AUTOMATIC POWER FACTOR CORRECTION

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Abstract; **This paper discusses the design, implementation and analysis of a single phase (240V, 50Hz) capacitor bank controller unit. Power factor correction using capacitor banks reduces reactive power consumption which will lead to minimization of losses and at the same time increases the electrical system's efficiency. Power saving issues and reactive power management has brought to the creation of single phase capacitor banks for domestic applications. The development of this project is to enhance and upgrade the operation of single phase capacitor banks by developing a micro-processor based control system. The control unit will be able to control capacitor bank operating steps based on the varying load current. Current transformer is used to measure the load current for sampling purposes. This project applies the Peripheral Interface Controller (PIC) microcontroller to produce switching commands in order to control the capacitor bank steps. Intelligent control using this micro-processor control unit ensures even utilization of capacitor steps, minimizes number of switching operations and optimizes power factor correction. Fluorescent lamp will be use as loads in this single phase capacitor bank developments. That fluorescent lamp shall be divided into different load value to enable capacitor bank model is controlled systematically.**

I. INTRODUCTION

In the present technological revolution, power is very precious so we need to find out the cause of power loss and improve the power system. Due to industrialization the use of inductive load increases and hence power system losses its efficiency. So we need to improve the power factor with a suitable method. Whenever we are thinking about any programmable device then the embedded technology comes into forefront. The embedded is now a day's very much popular and most of the product are developed with microcontroller based embedded technology. The project is designed to minimize penalty for industrial units by using automatic power factor correction unit. Power factor is defined as the ratio of real power to apparent power.

This definition is often mathematically represented as kW/kVA, where the numerator is the active (real) power and the denominator is the (active + reactive) or apparent power. Reactive power is the non-working power generated by the magnetic and inductive loads, to generate magnetic flux. The increase in reactive power increases the apparent power, so the power factor also decreases. Having low power factor, the industry needs more energy to meet its demand, so the efficiency decreases. energy to meet its demand, so the efficiency decrease. The proposed system, the time lag between the zero voltage pulse and zero current pulse duly generated by suitable operational amplifier circuits in comparator mode are fed to two interrupt pins of the microcontroller. It displays the time lag between the current and voltage on an LCD. The program takes over to actuate appropriate number of relays from its output to bring shunt capacitors into the load circuit to get the power factor till it reaches near unity. The microcontroller used in the project belongs to 8051 family.

II. PROPOSED SYSTEM

It is also to explain a control capacitor bank which used traditional microcontroller by using relay. Majority relay use currently was combined protection system function and traditional logic function in one device. This concept was applied in proposed system, to develop a basic control scheme for a capacitor bank with five consecutive models which use one microcontroller with relay. An application special relay is a control consecutive capacitor bank which can be activated required consecutive to accommodate voltage.

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Electrical energy is always in great demand for industrial usage. It is on the increase for the development of industrial applications. One of the most economical methods to meet the electrical energy demand is to improve the system efficiency by correcting the the power factor. The system efficiency is defined as the ratio of the real power to apparent power, called as power factor. The loads in electrical systems are generally fed by alternating current and they are mostly motors or the loads with inductive characteristic. They draw active and reactive power from the lines.

Active power is converted different types of energy, such as heat, mechanical energy. But, reactive power is not converted to any type of energy. The size of transformer and transmission lines can be larger than their rated values when the reactive power is not compensated. Reactive power occurs due to rotary field in alternative current machines and magnetic field in transformers. Therefore, the reactive is needed to transmit the active power. In practical applications, reactive power compensations have generally been achieved by employing constant capacitor groups controlled via some relays and contactors.

It is necessary to know power factor to achieve the reactive power compensations. The harmonic distortion of present-day power system has become a great concern due to the numbers of electronic equipment and power electronic devices are rapidly increased. A poor power factor can result in such systems. In order to reduce harmonic contamination in power lines and improve transmission line efficiency, power factor correction researches become a hot topic.

III. BLOCK DIAGRAM WITH DISCRIPTION

As Show in Fig 1.the supply signal Voltage and current is given by CT and PT to the rectifier unit which convert these ac signal to dc signal. Then this dc supply is given to regulator. There are two regulators are used 7805 and 7812. + 12V supply is given to ZCD(V) and ZCD(C) for their operation and also give to the LCD display unit. +5V supply is given to microcontroller. Operational amplifier act as comparator and generate dual pulses. These pulses are given to two interrupt pin that is INT0 and INT1 of microcontroller. Microcontroller have internal timer circuit which calculate time in ms which then convert into phase angle and power factor will display on LCD ..If Power factor will be low then microcontroller actuates relay and shut capacitor will come in contact with device which provide leading current .Thus Power factor will be improve and show on LCD .

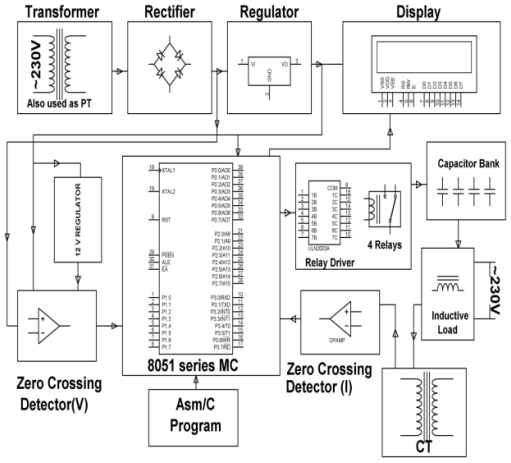

Fig1: Block Diagram of Automatic Power Factor Correction

IV. CONVENTIONAL METHOD

Following methods are used for power factor improvement.

1. Static compensation - If the power factor will be low due to inductive lagging current then static capacitors are connected in parallel with the devices then these capacitors provide leading current which neutralize lagging current and improves power factor .For three phase load capacitors are connected in star or delta. Static capacitor is invariably used in power.

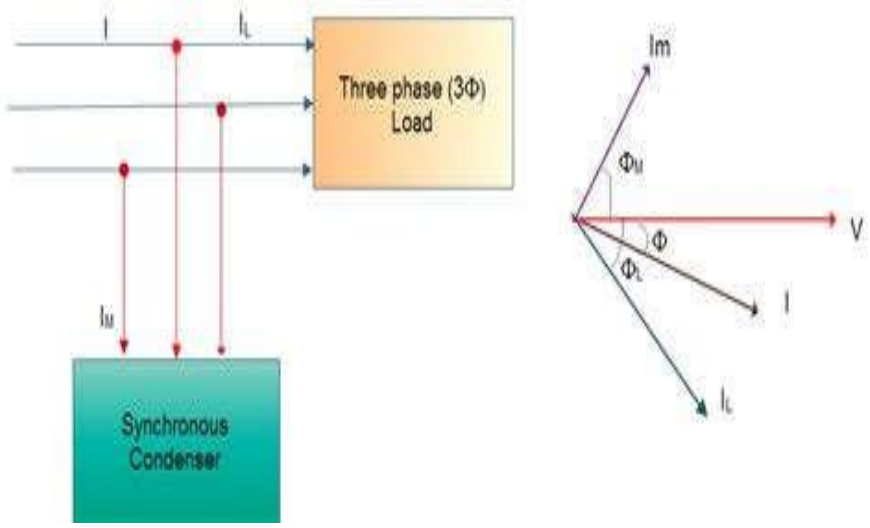

Fig 3: STATIC COMPENSATION

2.Synchronous condenser-When synchronous motor operates at under excited and at over excited condition then it is called synchronous condenser. It can generate and absorb reactive power. When synchronous motor is over excited it draws leading current and works like capacitor. When synchronous condenser provides leading current it eliminate reactive component and improve power factor.

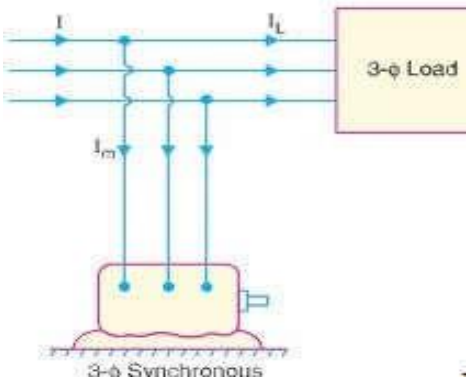

Fig: SYNCHRONOUS CONDENSOR

V. CONCLUSION

This method deals with modify method of automatic power factor correction. This method gives more accurate result than other methods. Thus we can conclude that from this system with increase in power factor we can save power and also efficiency can be increases and this system can be implemented in industries.

VI. FUTURE SCOPE

In this technique there is no anyone moving part and also no extra motor is required for power factor correction thus it has low cost as compared to synchronous compensation technique. As compare to static compensation technique it has long life. So Automatic Power Factor Correction Technique can use in industries in future. Also PWM method can be employed in this scheme.

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