POWER FACTOR IMPROVEMENT USING MICROCONTROLLER

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ABSTRACT

The thirst for new sources of energy is unquenchable, but we seldom realize that we are wasting a part of the electrical energy everyday due to the lagging power factor in the inductive loads we use. Hence, there is an urgent need to avoid this wastage of energy. Before getting into the details of Power Factor Correction, let us just brush our knowledge about the term power factor. In simple words, power factor basically states how far the energy provided has been utilized. The maximum value of power factor is unity. So the closer the value of power factor to unity, better is the utility of energy or lesser is the wastage. In electrical terms, power factor is basically defined as the ratio of active power to reactive power or it is the phase difference between voltage and current. Active power performs useful work while reactive power does no useful work but is used for developing the magnetic field required by the device. Most of the devices we use have power factor less than unity. Hence, there is a requirement to bring this power factor close to unity. Here we are presenting a prototype for automatic power factor correction using the 8-bit AVR microcontroller Atmega328.

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 about the development 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 microprocessor based control system. The control unit will be able to control the individual capacitors in the capacitor bank and will operate in steps based on the variation in power factor. Current transformer and a Voltage transformer are used for sampling of the circuit current and voltage, so as to determine the power factor.

An Automatic power factor correction device reads power factor from line voltage and line current by determining the delay in the arrival of the current signal with respect to voltage signal from the source with high accuracy by using an internal timer. It determines the phase angle lag (Φ) between the voltage and current signals and then determines the corresponding power factor (cosΦ). Then the microcontroller calculates the compensation requirement and

accordingly switches on the required number of capacitors from the capacitor bank until the power factor is normalized to about unity. Automatic power factor correction techniques can be applied to industrial units, power systems and also households to make them stable. As a result the system becomes stable and efficiency of the system as well as of the apparatus increases. Therefore, the use of microcontroller based power factor corrector results in reduced overall costs for both the consumers and the suppliers of electrical energy. 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 led to the development of single phase capacitor banks for domestic and industrial 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. Intelligent control using this micro-processor control unit ensures even utilization of capacitor steps, minimizes number of switching operations and optimizes power factor correction. The Choke used in the Compact Fluorescent Lamp (CFL) will be used as an Inductive load.

Currently, the effective use of the capacitor bank as power factor correction device has been its use as a capacitor bank for domestic use. Also known as energy stability, it will correct power factor based on the concept of employing a capacitor as a compensator of reactive current in the single phase electric circuit. However, this device proves to be less efficient because of its static operation i.e. the compensation does not vary with changes in the load. The project titled ―Automatic Power Factor Correction was developed to enable operation of a single phase capacitor bank to control the power factor such that it follows the change in the load. The present single phase capacitor bank was not able to operate with an increase or reduction in the load on the power system. Because the present system could not detect load rating that changed, its operation was inefficient and power factor correction thus obtained was not optimum.

The Automatic Power Factor Detection and Correction provides an efficient technique to improve the power factor of a power system by an economical way. Static capacitors are invariably used for power factor improvement in factories or distribution line. However, this system makes use of capacitors only when power factor is low otherwise they are cut off from line. Thus, it not only improves the power factor but also increases the life time of static capacitors. The power

factor of any distribution line can also be improved easily by low cost small rating capacitor. This system with static capacitor can improve the power factor of any distribution line from load side.

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