Minimizing Penalty in Industrial Power Consumption By Engaging APFC Unit

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Abstract: In the present innovative upset power is valuable. So we have to discover the reasons for control misfortune and enhance the influence framework. Because of industrialization the utilization of inductive load increments and thus control framework misfortunes its productivity. So we have to enhance the power factor with an appropriate strategy.At whatever point we are considering any programmable gadgets then the inserted innovation comes into fore front. The installed is presently a day especially mainstream and most the item are produced with Microcontroller implanted technology. Automatic control factor remedy gadget peruses control factor from line voltage and line current by deciding the deferral in the landing of the present flag as for voltage motion from the capacity generator with high precision by utilizing an inward clock. This time esteems are then adjusted as stage point and relating power factor. At that point the qualities are shown in the 2X16 LCD modules. At that point the motherboard ascertains the remuneration prerequisite and appropriately switches on various capacitor banks. This is produced by utilizing 8051 microcontroller. Automatic power factor correction techniques can be applied to the industries, power systems and also house holds to make them stable and due to that the system becomes stable and efficiency of the system as well as the apparatus increases. The use of microcontroller reduces the costs

Keywords: APFC, Apparent power, Capacitor bank, Power factor and Microcontroller.

INTRODUCTION

The low power factor leads to the increase in the load current, increase in power loss, and decrease in efficiency of the overall system. In previous various method use for power factor correction in all this method, the switching of the capacitor is manual. In this paper we are using a method of the reactive power compensation by capacitor switching with automatic control using AVR microcontroller [1].

POWER FACTOR
The power factor is the proportion of active power to the apparent power .The active power is the genuine power conveyed to the heaps, for example, engines, lights and so forth. The reactive power is utilized only to produce attractive field for the stream of active power. The apparent power is the blend of the active and reactive power. The heap current of any engine comprise of the resistive segment and inductive segment. The inductive segment comprises of magnetizing current and leakage current. The leakage current is absolutely reliant on the heap current however the magnetizing segment is adjacent 20 to 60% of the full load current. The capacitors are utilized to lessen inductive reactance in the enlistment engine in this way lessening misfortunes in the supply [2].

SOURCES OF REACTIVE POWER (INDUCTIVE LOADS) DECREASE THE POWER FACTOR [3]

-Transformers
-Induction Motors
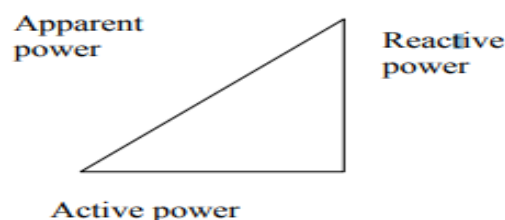-Induction generators (wind mill generators)
-High Intensity (HID) lighting

Fig- Power Triangle

BENEFITS OF POWER FACTOR CORRECTION

The advantages that can be achieved by applying the power factor correction are [4]:

- *Environmental benefit-reduction of power− consumption due to improved energy efficiency. Reduced power consumption means less greenhouse gas emissions and fossil fuel depletion by power stations.*
- *Reduction of electricity bills.*
- *Extra KVA available from the existing supply. In transformers and distribution equipment (I*I)R losses decrease.*
- *In long cables reduction of voltage drop.*
- *Extended equipment life.*
- *Reduced electrical burden on cables and electrical Component.*

BLOCK DIAGRAM
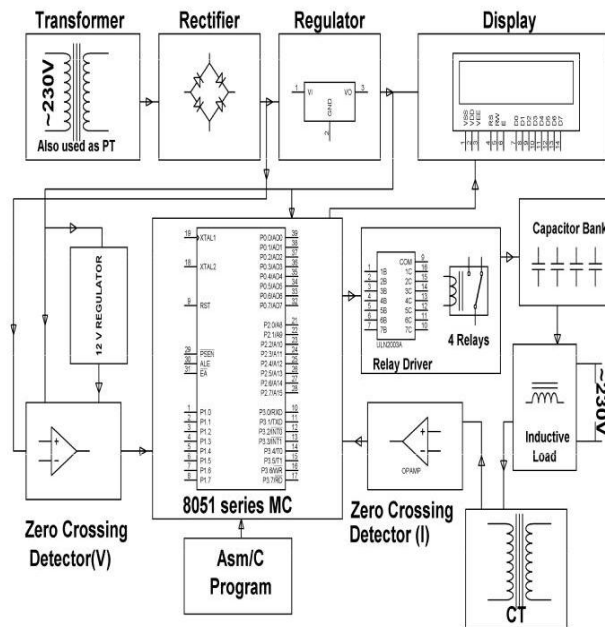
HARDWARE

- *CT & PT*
- *Comparator unit*
- *Resistor divider network*
- *AVR*
- *LCD*
- *Relay*
- *Capacitor bank*
- *Lamp load .*

Voltage and current estimation unit

Current transformer (CT) is associated arrangement with line, and Potential transformer (PT) is associated parallel with supply line. CT and PT are utilized to venture down the voltage and current for resistor divider organize.

Comparator unit

It looks at the estimation of voltage and current from CT and PT and gives this incentive to microcontroller.

AVR

The ATmega328 is a solitary chip microcontroller made by Atmel in the mega AVR family. The ATmega328 is normally utilized as a part of numerous tasks and independent frameworks where a basic, low-fueled, ease small scale controller is required.

LCD

A microcontroller program must cooperate with the outside world utilizing information and yield gadgets that Communicate specifically with an individual. A standout amongst the most widely recognized gadgets connected to a microcontroller is a Liquid precious stone show. The absolute most regular LCDs associated with the microcontroller are 16x2 and 20x2 presentations.

Resistor divider organize

Resistor voltage dividers are generally used to make

reference voltages, or to diminish the extent of a voltage so it can be estimated. A straightforward case of a voltage divider is two resistors associated in arrangement, with the information voltage connected over the resistor combine and the yield voltage rising up out of the association between them.

Relay

Hand-off yields are given which work to associate or separate the capacitor banks relying on of the power factor conditions.

Capacitor bank

Capacitor bank is a get together of number of capacitors which are utilized to contribute KVA in the electrical framework and at long last enhance the power factor. Shunt capacitors bank are game plans of arrangement/paralleled associated units.

Steps of operation:-

1) Two signals (voltage and current) are presented in Microcontroller from line by utilizing C.T and P.T.
2) Microcontroller ascertains stage point between this two flags by estimating time interim utilizing clock.
3) Microcontroller ascertains the power factor by formula (Cos X stage edge) .
4) Then it ascertains the required compensation.
5) From given pay it offers flag to Relay.
6) Then Contactors work on the relay signal.
7) The required capacitors are included framework.
8) As capacitors are included, power factor gets expanded.
9) Power factor is shown in LCD.

Software requirement:

▪   Embedded C
▪   Flash magic
▪   Keil software

ADVERSE EFFECT OF OVER CORRECTION

• Power system becomes unstable
• Resonant frequency is below the line frequency
• Current and voltage increases

Results-

This method of improving the power factor gives rise to the correction of power factor of inductive load.

CONCLUSION

It can be concluded that power factor correction procedures can be connected to the industries, power system and furthermore house holds to make them stable and because of that the framework winds up stable and efficiency of the system and in addition the mechanical assembly increases. The utilization of microcontroller diminishes the expenses. Because of utilization of microcontroller different parameters can be controlled and the utilization of additional equipment, for example, clock, RAM, ROM and info yield ports decreases. Care ought to be taken for overcorrection generally the voltage and current turns out to be more because of which the power framework or machine winds up temperamental and the life of capacitor banks lessens.

REFERENCES

[1]   Sagar Jundare, Pranav Ukkadgaonkar, Minimizing Penalty in Industrial sector By Engaging Automatic power correction panel using microcontroller.

[2]https://en.wikipedia.org/wiki/Power_factor

[3]http://www.electricaltechnology.org/2013/10/causesof-low-power-factor.html

[4] Power factor correction By John Ware

[5]Muhammad Ali Mazidi and Janice Gillespie Mazidi, "Microcontroller and Embedded Systems".

[6] IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONIC VOL NO 3FEBRUARY 1990 77A Microprocessor-Based Adaptive Power Factor Corrector for Nonlinear Loads H. M. ELBOLOK,M. E. MASOUD, AND M. M.MAHMOU.

[7] P. N. Enjeti and R artinez "A high performance single phase rectifier with input power factor correction", IEEE Trans. Power Electron…vol.11, No.2, Mar.2003.pp 311-317.

[8] "Electronic device and circuit" by Robert L. Boylested, Louis Nashelsky

[9] POWER SYSTEM" by J.B Gupta.

[10] J.G. Cho,J.W. Won,H.S. Lee , "Reduced conduction loss zero-voltage-transition power factor correction converter with low cost,"*IEEE* Trans Industrial Electron..vol.45,no 3,Jun. 2000,pp395-400.

[11] Anant Kumar Tiwari, "Automatic Power Factor Correction Using Capacitive Bank", International Journal of Engineering Research and Applications, Volume 4, issued February 2014.

[12] Keith Harker (1998). "Power System Commissioning and Maintenance practice." London: Institution of Electrical Engineers.

WEBSITES
    www.atmel.com