Minimising Penalty in Industrial Power Consumption by using APFC Unit and Maximum Demand Controller

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Abstract— The objective of paper is to minimizing the penalty of industries by improvement of power factor and maximum demand controller. In first method the industries used various load continuously running condition because of this the inductive load increases. So the power factor of system get reduces due to effect of inductive reactive power but the electricity board having standard limit regarding power factor value and if power factor of system reduces below the specified limit than electricity board charge penalty to industrial consumer .This penalty of industries is reduce by designing automatic power factor correction (APFC) unit. In second method in India, electricity demand is greater than the generation of power. Many industrial organization and various institutions used lot of power from grid but fail to utilize it in an efficient and economical way. In many case consumers draw excess of power than there sanctioned demand. They consumer's pay the penalty to electricity board. Electrical energy can be utilized in proper way by using maximum demand controller. This paper illustrates how the maximum demand monitored and controlled using microcontroller. A prototype is designed we have to considering the various load and priority wise load switching is controller by the microcontroller in order to maintain the desired maximum demand.

Key words: Power Factor, Penalty, AVR, Microcontroller, Capacitor Bank, Induction Motor, Contractor and Current Transformer, Potential Transformer, Priority Wise Load Switching, Auto Restoration, Maximum Demand

I. INTRODUCTION

In a present world of technology it has been observed that power is very precious for all and also demand of power is always high. The demand of power is increasing day by day due to more industrialization, increase in inductive load etc. Hence the use of more inductive load in industries and at house hold, the systems power factor get lagging in nature that means the system power factor gets poor due to excess of reactive power consumed by the inductive load which increases the reactive losses. Electrical energy consumption of the country is one among the most parameter to come to a decision the event of country. It has been a critical and essential resource for all nation building activities which will develop the country and improves economy of the country. Due to this the demand of electricity is increasing day by day from domestic, commercial and Industrial sector. In recent times the life in the society has become very luxurious, that is the use of electronic goods and equipment's has increased. This has resulted in the rise of electrical power demand, whereas the production of electricity remains same. It has resulted in a {very} very vast gap between the generation and consumption. To balance the system the conventional method is to cut the loads for long time during the peak hours i.e. load shedding. This leads to inconvenience of the consumers. Only the option left to beat the burning downside is to use the on the market wattage additional effectively and efficiently. We utilizes some key terminologies like maximum demand, peak load and connected load.Maximum demand is that the greatest demand of the load on the facility station throughout a given amount. The load on the power station is dynamic. Uncontrolled most demand will have an effect on the total facility. There is possibility of unwanted power transmission and unwanted utilization due to uncontrolled maximum demand. Hence, it is important to control maximum demand. It may be management in keeping with the provision of load at specific instance. The peak load issues overcome by management over the usage of electrical hundreds throughout peak hours. This can be done by fixing the priorities to the loads with respect to time. Generally during morning and evening there are peak hours but the priority of loads during this peak hours is different so by keeping low priority load off during peak hours one can remove the burden on the supplier. Generally charge of electricity is finished by exploitation 2 half tariff. This is based on the number of units consumed by the consumer and maximum demand, if the consumer exceeds the maximum demand limit he has to pay penalty for that extra demand. This will increases the cost of electricity. The permanent remedy to pacify the problem partially can be achieved by controlling the usage of non-vital hundreds throughout peak hours.

II. LITERATURE SURVEY

The paper entitled "An Overview of Power Factor Improvement Techniques in Domestic and Industrial Loads", the author's Silpa Thomas, Anjali Shalimar, Unnikrishnan L. have proposed that suitable circuit for Automatic power factor correction can be developed and the same technique can be applied to the industries, power systems and households such that stability of the system can be increased. . It is economical to use microcontroller for the development of the circuit. The paper entitled," An Efficient AC/DC Converter with Power Factor Correction" the author's Suja C Rajappan , K. Sarabose , Neetha John have proposed , several techniques for power factor correction and harmonic reduction have been reported and a few of them have gained greater acceptance over the others. In this paper a bridgeless power factor correction boost converter is proposed which results in improved power factor and reduced harmonics content in input line currents as compared to conventional boost converter topology. Bridgeless power factor correction boost converter eliminates the line-voltage bridge rectifier in conventional boost power factor correction converter, so that the conduction loss is reduced.

III. BLOCK DIAGRAM/DESCRIPTION

A. Automatic Power Factor Correction Unit

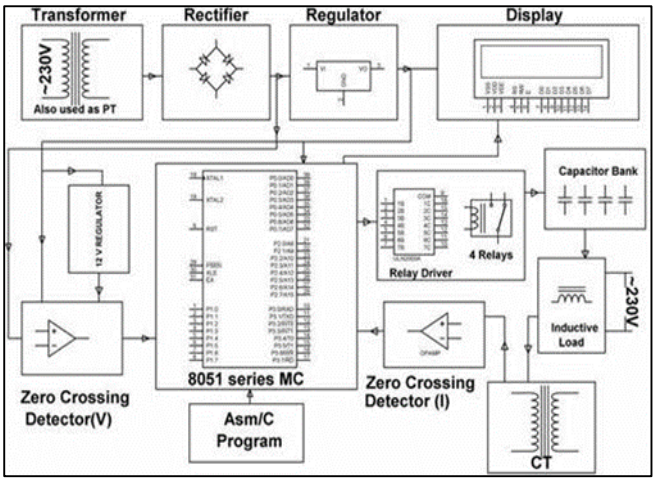

Fig. 1: Block diagram of APFC unit

Power to the circuit is fed from a step down transformer where an rectifier is used for converting AC-DC and regulated. The wait between the zero voltage pulse and 0 current pulse punctually generated by appropriate operational electronic equipment circuits in comparator mode are fed to 2 interrupt pins of the 8051 microcontroller. The time lag between the current and voltage are displayed on LCD which is interfaced with microcontroller. Depending upon the delay the program which has been dumped in the microcontroller brings appropriate number of relays through relay driver IC from its output to bring shunt capacitors into the load circuit to get the power factor , till it reaches nearest to unity.

Further the project can be enhanced by using thyristor control switches instead of relay control to avoid contact pitting often encountered by switching of capacitors due to high rush current

B. Maximum Demand controller

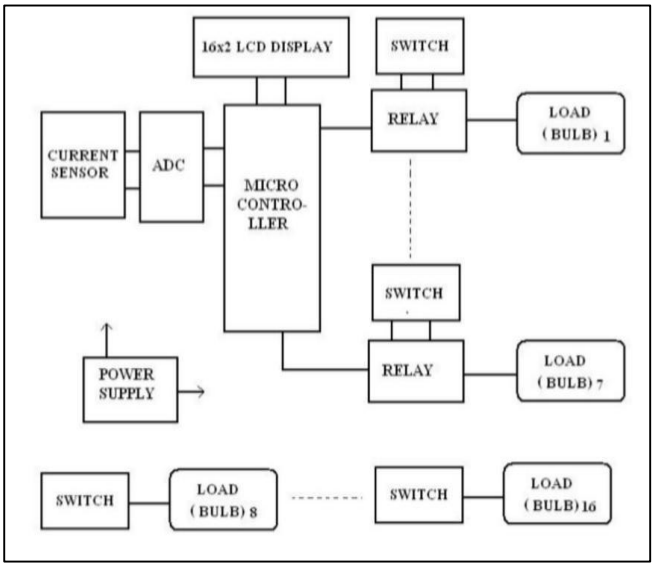

Fig. 2: Block Diagram of Maximum demand controller

To virtualize the control of maximum demand of any organization a prototype is designed using resistive (bulb) loads. A most demand of roughly 1600 Watts (1.6 kW) is set for the prototype. As the loads used in the prototype are purely resistive loads the power factor considered here is unity (1) and therefore the maximum demand in kVA is approximately equal to 1.6 kVA. To sense the load total current drawn by the loads is used as a sensing parameter. The current sensor senses the current drawn by the loads and gives a corresponding (analogue) voltage to the ADC which in turn gives corresponding digital output which is comprehended by the microcontroller and explicit relay is tripped. When in the prototype the ON load is below or adequate to one.6 kVA the setup works in traditional condition. As soon as the load exceeds the set demand the least priority load switches off first and again the maximum demand is checked with the corresponding current drawn. once the set limit of most demand is once more exceeded future least priority load visits. These loads are tripped from the load banks 2 & 3. Next, if the ON loads are limits the loads which were tripped off auto reclose themselves.

IV. MAIN COMPONENTS DESCRIPTION

A. Power supply

We have to used step down Transformer .The 230V ac is given to primary of transformer to step down the voltage as per requirement of devices. The transformer is a electromachenical Device that transforms one from energy to a different from while not dynamic in frequency.

B. Rectifier

The main function of rectifier is to convert Ac input into Dc output. This dc is pulsating dc. The diodes is main components of rectifier circuit it conducts in one direction. The properties of diode to convert ac wave into pulsating Dc.

C. Voltage Regulator

The main application of voltage Regulator is to convert variable dc output into constant dc voltage. Which is required for microcontroller and zero crossing detector.

D. Microcontroller

Microcontroller could be a IC chip that executes programs for dominant alternative devices or machines. Its a micro sized IC chip device which is used for control of other devices and machines, that is why it is called microcontroller. It is a chip having RAM, ROM and I/O ports. 8051 microcontroller is employed in automatic power issue correction panel. The microcontroller receives the load current in the line and gives the signal to the relay driver and simultaneously connects the. capacitors as per the need.

E. Relay

Relay is an electro-magnetic switch that will be used whenever we want to use an occasional voltage circuit to modify a lightweight bulb ON and OFF that is connected to 220V mains supply. The required current to run the relay coil is over may be supplied by numerous integrated circuits like Op-Amp, etc. Relays have unique properties and aware placed the solid state switches that are sturdy than solid-state devices. High current capacities, capability to stand ESD and drive circuit isolation are the unique properties of Relays. There are various ways to drive relays.

F. Relay Driver IC Circuit

Relays are elements that let a low-power circuit to manage signals or to switch high current ON and OFF that ought to be electrically isolated from dominant circuit. Driver Circuit is used to boost or amplify signals from micro-controllers to control power switches in semi-conductor devices. Driver circuits take functions that include uninflected the feedback loop and also the power circuit, detecting malfunctions, storing and news failures to the system, serving as a precaution against failure, analyzing sensor signals and creating auxiliary voltages.

G. Zero crossing detector

Zero crossing sight or circuit is style to detect zero crossing of wave. It is used for AC Power control circuits. If you're associate degree physics engineer and you're working on power electronics projects, you may come across many situations where you have to read frequency of sine wave or you want to detect zero crossing of sine wave. Whenever wave cross from positive cycle to negative cycle or negative cycle to positive cycle. You can conjointly sight zero crossing of wave with the assistance of easy operational amplifier. I have already announce an editorial on zero crossing detection victimization op-amp.

H. LCD

LCD Modules can present textual information to user. It‘s like a cheap ―monitor that you can hook in all of your gadgets. They come in various types. The most popular one is 16x2 LCD Module. It has 2 rows and 16 columns.

I. Capacitor Bank

The 3 most typical varieties of load banks are resistive, inductive, and capacitive. Both inductive and electrical phenomenon masses produce what's called electrical phenomenon in an AC circuit. Reactance could be a circuit element's opposition to associate degree AC,caused by the buildup of electrical or magnetic fields within the component because of the present and is the "imaginary" part of ohmic resistance, or the resistance to AC signals at a certain frequency. Capacitive reactance is equal to $1/(2\cdot\pi\cdot f\cdot C)$, and inductive reactance is equal to $2\cdot\pi\cdot f\cdot L$. The unit of reactance is the ohm. Inductive reactance resists the change to current, causing the circuit current to lag voltage. Capacitive reactance resists the change to voltage, inflicting the circuit current to guide voltage.

A electrical phenomenon load bank or capacitance bank is associate degreealogous to an inductive load bank in rating and purpose, except leading power issue hundreds square measure created, therefore reactive power is supplied from these loads to the system, hence improves the power factor. These loads simulate sure electronic or non-linear hundreds typical of telecommunications, computer or UPS industries.

V. CONCLUSIONS

In our project “Minimizing Penalty in Industrial Power Consumption by participating APFC Unit And most Demand Controller” within which the advanced technique of the facility issue correction by victimisation the AVR and Automatic power issue correction unit that has the numerous benefits over the varied strategies of the facility issue correction. The shift of capacitors is finished mechanically by victimisation the contactors and therefore the facility issue correction is additional correct. Thus in this paper presented the possible advanced method for the correction of the power factor. A good record of the load pattern is obtained that allows correct predictions and higher load distribution. The capital outlay for max demand management is low. With good maximum demand indication, it is possible to create awareness of where and when power is used and consequently gets greater power utilization. The data obtained from the MDI controller may be used for the design and development of Smart Grid. Helpful for prediction of calculable load in giant load dispatch centre. Proper utilization of wattage throughout off peak amount. The data obtained from the MDI controller is useful for the automation of Distribution system.

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