POWER SAVER METER USING MICROCONTROLLER TO SAVE ELECTRICITY UPTO 30-40%

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Abstract

In our project, we are going to monitor the power of the system especially known as industries and controlling the power line using power factor. Here the current transformers and potential transformers are widely used for analyzing the performance of the power plant and it is given to the circuit.

Then it gives to an ADC circuit for giving to the micro-controller. The capacitor bank is powered and the power factor which produces from the power plant is gathered first and depending upon that one, the capacitor banks are used to power the power plant to the uninterrupted working of the industries. Everything will be monitored using a LCD display.

Power factor correction method is used only for inductive load not for resistive load. So when system is off state at that time capacitor bank produce back current and it's damage system. So automatic power factor correction method is used to control this back current.

Keywords:
Microcontroller,Capacitor bank, Hall current sensor.

1 Introduction

A Power Saver is a device which plugs in to power socket. Apparently just by keeping the device connected it will immediately reduce your power consumption. It is known that

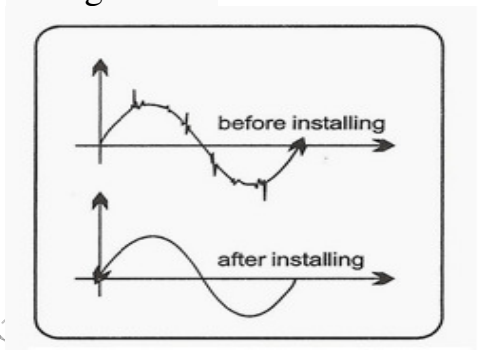
electricity comes in our home is not stable in nature. There are many fluctuations, raise and falls, and spikes in this current. This unstable current may damage instruments. The fluctuating current wastes the electric current in the form of heat energy. To reduce these losses capacitor bank used and power factor should be unity. To control power factor unity power triangle calculation is used.

Power Saver stores the electricity inside of it using a system of capacitors and they release it in a smoother way to normal without the spikes. The systems also automatically remove "CARBON" from the circuit which also encourages a smoother electrical flow. This means that we will have less power spikes.

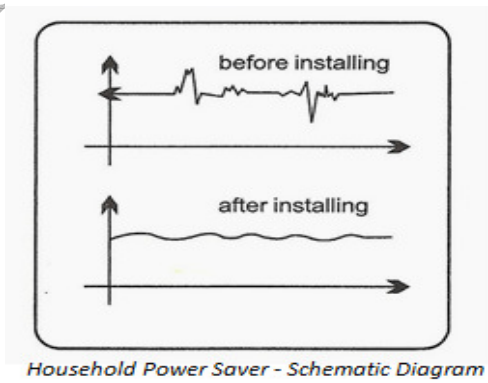
The main advantage of power savers is not that they provide a **backup system in times of low current**, but that it protects the household appliances. It is known that a sudden rise in the power can destroy the electrical appliance. Thus, the power saver not only protects the appliance but also increases its life. Moreover, they also reduce the energy consumption and thus the electricity bills.

1.1 Scope of project

It is known that the electricity that comes to our homes is not stable in nature. There are many fluctuations, raise and falls, and surges/Spikes in this current. This unstable current cannot be used by any of the household appliances. Moreover, the fluctuating current wastes the electric current from the circuit by converting electrical energy into heat energy. This heat energy not only gets wasted to the atmosphere, but also harms the appliances and wiring circuit.



Household Power Saver - Schematic Diagram



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Power savers use capacitors for this purpose. When there is a surge of current in the circuit, the capacitor

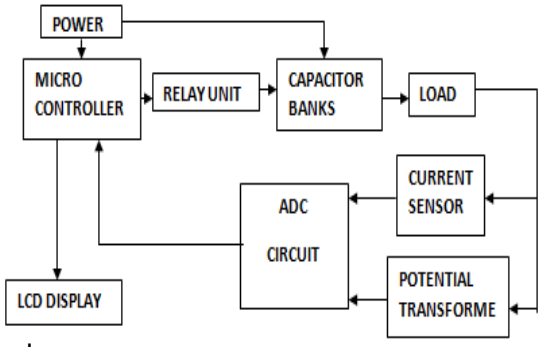
of the power saver stores the excess current and releases it when there is a sudden drop. Thus only smooth output current comes out of the device.

2 Description of Operation

For any inductive load power saver is used to reduce starting current using capacitor bank. Supply is given to the hall current sensor. Current sensor gives signal to A to D converter. To drive A to D converter 7414 clock frequency generator is used. Then signal is supplied to microcontroller which is the heart of the system. Microcontroller gives signal to driver circuit(ULN2003) and this driver circuit is used to operate relay unit and capacitor bank.

When inductive load is connected to circuit, capacitor bank is charged and power factor starts improving. Then relay operates and capacitor starts to discharge and gives current to load without spikes.

The entire circuitry is explained below.

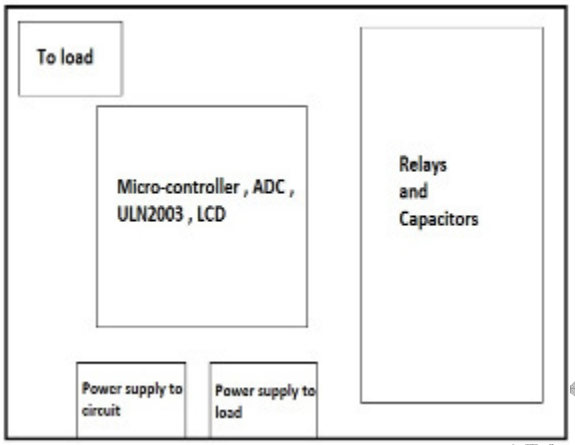


The heart of this circuit micro-controller(89s52) is used to control all components. The basic need of micro-controller is +5v dc supply, reset circuit and clock oscillation frequency. Power supply circuit is used to convert 250v AC to 5v and 12 v DC supply. Automatic power factor correction method is used to control power factor at unity. Here CT and PT are connected to A/D converter which converts analog data in digital format and gives to micro-controller then micro-controller gives signal to ULN2003 driver circuit which is used to drive relays then output of this circuit is display on LCD .

We are using a capacitor bank and relay unit with ULN2003. ULN2003 is a driver circuit and we can't connect relay unit directly with micro-controller.ULN2003 is connected to micro-controller and receive signals from it and operates relay unit and gives output to LCD screen.

Here we use ADC0808 8-bit A/D convertor for convert analog data to digital data. To run ADC0808 circuit a clock frequency generator 7414 IC is used and it's produce clock frequency 12 kHz. 7414 IC requires 5v dc supply to operate. Higher the clock frequency higher the speed of convertor. Only two input pin 26 and 27 is used for input. Pin 26 is connected to PT section and pin 27 is connected to current sensor. Address lines 0 to 7 connected with micro-controller and 4.7K resistor bank is used to remove spikes from output of convertor. ADC0808 is

connected with micro-controller 89s52. Micro-controller requires 5v dc supply. Pin 0 and pin 2 are connected with 16*2 LCD. Crystal frequency of micro-controller is 11.59 kHz. A reset pin is used to reset micro-controller.ULN2003 is used to operate relay R1, R2, R3, R4. According that capacitor is connected with load.



3. Detail of Components

3.1 AT89s52 micro-controller

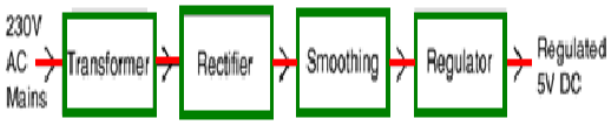
The whole processing of the device is done by a micro-controller. The micro-controller 89s52 is a small but powerful micro-controller from Microchip .The AT89S52 is a low-power, high-performance CMOS 8-bit micro-controller with 8Kbytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful micro-controller which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

3.2 Power supply circuit

The entire electronics component such transistor, integrated circuits, etc generally requires DC for their operation. So AC supply is then stepped down. Now this stepped down AC is converted to DC supply by rectification process .there may be some ripples coming out of

rectifying unit is bypassed by connecting the capacitor in parallel. Then 12v supply given to the LM7805 regulator. Now as micro-controller, LCD module, relays and other certain ICs requires 5V DC supply for their operation we need a regulated uninterrupted 5V DC supply. This block involves production of 5V DC supply for whole circuit.



Every circuit requires power for its operation. Here we require +5v dc to operate Micro-controller, Relays, and certain ICs.

The supply voltage of 230v ac is step downed to 12v by using the step-down Transformers. As the circuit requires only the dc supply the in fed ac is converted to dc by using the rectifying unit.

The rectifying unit consists of bridge rectifiers comprising diodes for rectification Purpose. Any of the ripples coming out of the rectifying unit is bye passed by connecting the Capacitor in parallel. As the micro-controller circuit requires only +5v dc supply, the outputs is further diminished by the regulator (LM7805) for accurate +5v to the micro-controller circuit. The capacitor is connected in parallel for suppressing the ripples.

3.3 Hall current sensor (ACS712)

It is also called as linear hall sensor with copper conduction path. It is not used in automotive application. It is used in motor control, switched mode power supply ,over current fault protection, load detection.

Voltage at the output terminal is equal to the Ip+ and Ip- which makes its use very easy.

There are two capacitors for filtering the power supply and output. Here output voltage is same as input current.

3.4 ULN2003

The ULN2001A, ULN2002A, ULN2003 and ULN2004A are high voltage, high current darlington arrays each containing seven open collector darlington pairs with common emitters. Each channel rated at 500mA and can withstand peak currents of 600mA. Suppression diodes are included for inductive load driving and the inputs are pinned opposite the outputs to simplify board layout. These versatile devices are useful for driving a wide range of loads including solenoids, relays DC motors, LED displays filament lamps, thermal print-heads and high power buffers.

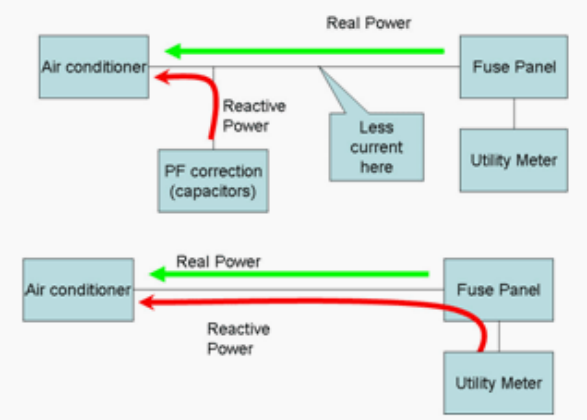
3.5 ADC0808

The ADC0808 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique. The converter features a high impedance chopper stabilized comparator, a 256R voltage divider with analog switch tree and a successive approximation register. The 8-channel multiplexer can directly access any of 8-single-ended analog signals. The device eliminates the need for external zero and full-scale adjustments. Easy interfacing to microprocessors is provided by the latched and decoded multiplexer address inputs and latched TTL TRI-STATE® outputs.

The design of the ADC0808 has been optimized by incorporating the most desirable aspects of several A/D conversion techniques. The ADC0808 offers high speed, high accuracy, minimal temperature dependence, excellent long-term accuracy and repeatability, and consumes minimal power. These features make this device ideally suited to applications from process and machine control to consumer and automotive applications.

6. Application Areas

We can use power saver for inductive load. The Fig shows the result of using Power Saver. The air conditioner (which has a large compressor motor) is still consuming reactive power but it is being supplied by a nearby capacitor. If you were to mount it at the air conditioner and switch it on with the air conditioner plus you sized the capacitor perfectly, then there would be no reactive power on the line going back to the fuse panel.



7. Further advancement:

We can save electricity boll up to 20-30%. It is used to reduce spikes or over voltage which may damage the system . using this circuit we can improve power factor to unity and reduce electricity bills.

8. Conclusion

The microcontroller with LCD makes it user friendly and can be embedded in a single unit. The circuit has been implemented on bread board and tested for to control power factor at unity and used to reduce electricity bills. To protect the system from spikes and overload. Installation capacitor bank for power factor correction will obtain profitable both sides consumer and electric flow. Thesis also shows capacitor bank was used extensively by the high-power user as industry sector and commercial.

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