Electrical Data Monitoring & Controlling and Power Factor Correction using PIC18F458

[1]J.M.Nikhate, [2]P.K.Suryatale,[3]S.D.Shinde,[4] B.U.Ughade,[5]N.Mishra

[1234]Student, of Electrical Engineering,

[#5] Asst.Prof.of Electrical Engineering,

Department Of Electrical Engineering,

JSPM'S Bhivarabai Sawant Institute of Technology And Research Wagholi, Pune 412207

Abstract: In recent years, the power quality of the ac system has become great concern due to the rapidly increased numbers of electronic equipment, power electronics and high voltage power system. Most of the commercial and industrial installation in the country has large electrical loads which are severally inductive in nature causing lagging power factor which gives heavy penalties to consumer by electricity board. This situation is taken care by PFC. Power factor correction is the capacity of absorbing the reactive power produced by a load. In case of fixed loads, this can be done manually by switching of capacitors, however in case of rapidly varying and scattered loads it becomes difficult to maintain a high power factor by manually switching on/off the capacitors in proportion to variation of load within an installation. This drawback is overcome by using an APFC panel. In this paper measuring of power factor from load is done by using PIC microcontroller and trigger required capacitors in order to compensate reactive power and bring power factor near to unity.

Keywords**:** Power factor, PIC, Hardware.

I. INTRODUCTION

In the past many years many researchers have been able to provide good and accurate designs for the measurement of the electrical power digitally. Attempts were based on different methods, e.g. using microprocessor, linear or non-linear ADC, etc. In this work a simple approach has been tried to realize active and reactive power digitally. This approach is based on the generation of three values by means of analog circuit, these values are proportional to V_m, I_m, cosø and sinø, thus multiplication by using microcontroller will result in V_m I_m cosø, i.e. active power and V_m I_m sinø, i.e. reactive power. This project introduces a simple method for the measurement of active and reactive power digitally using microcontroller PIC18F458. As we discussed above these project introduces a simple method for the measurement of active and reactive power digitally using microcontroller PIC18F458. This is also done by PLC and SCADA panels in large scale industries. These panels are so expensive and accommodate large space. But the circuits we do is much cheaper and accommodate less space compare to PLC and SCADA panels and this circuit is use not only in small scale industries but also use for domestic purpose.

LITERATURE SURVEY

BACKGROUND STUDY:

1) Ms.Sivasankari.J.,M.E , Asst.Prof. Dept of EEE, Sri Krishna College of Technology**.**

According to inventor, now a day's electrical parameters monitoring and pf improvement is very much necessary. Introducing modern technology we can avoid use of lagging PF.Power factor correction is the capacity of absorbing the reactive power produced by a load. Which is a dc-dc boost converter which steps-up the given input voltage in desired value.

RELATED WORK:

1) Suggested and automatic power factor correction based on Alienation technique. And alienation technique was developed for calculations of original power factor online, active and compensation reactive power and determination of the required number of capacitor bank to get the desired power factor.

2) The design of power factor using PIC18F458 chip with reduced part count to achieve desired efficiency and low cost. The solution involves ensuring the power factor value from the load and uses and algorithm to determine and triggered switching capacitor in order to compensate for excessive reactive components to increase power factor values

SYSTEM ARCHITECTURE:-
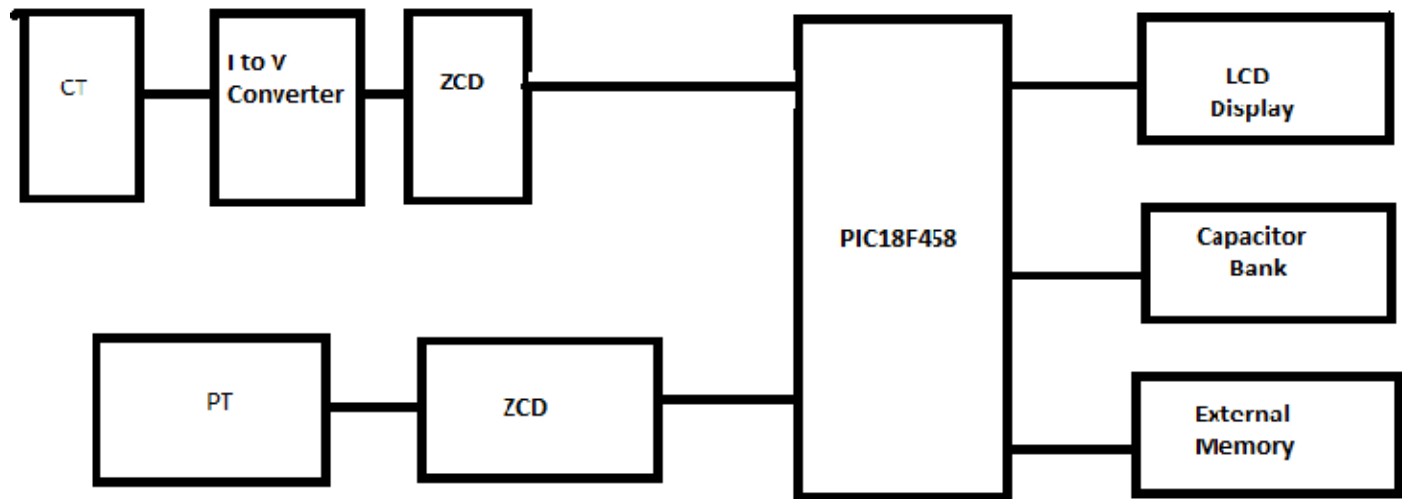
. Fig.1.1 Working Block Diagram

WORKING PRINCIPAL

In the system using PIC18F458 Microcontroller to improve the power factor in the system.
As motor rotates in forward direction it connects both the bridges again so that people can walk easily walk over the bridge and Consider a normal three wire power system, where voltage and current signals under steady-state conditions are of sinusoidal nature. Thus the instantaneous voltage *v(t) and current i(t)* are given as follows:

$$v(t) = Vm\ Sin\ (wt)$$
$$i(t) = Vm\ Sin(wt+\phi)$$

Where Vm is the peak value of the line voltage, Im is the peak value of line current, and ø is the phase angle between line voltage and line current (leading or lagging).
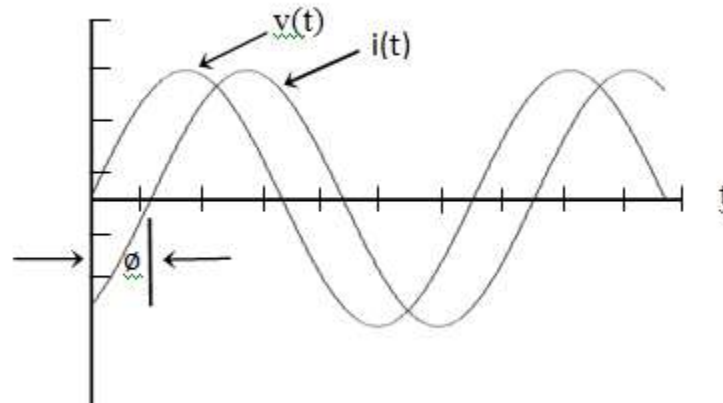

Fig 1.2 Voltage and Current waveforms

REQUIRED COMPONENTS

1) PIC18F458: In 1989 microchip technology corporation introduced an 8 bit microcontroller called the PIC, which stands for Peripheral Interface controller. This microcontroller had small amount of data ram, few hundred bytes of on chip ROM for the program. They are 8bit processors, meaning that the CPU can work on only 8 bits of the data at a time. They include the PIC families of 10xxx, 12xxx, 14xxx, 16xxx, 17xxx, 18xxx. The PIC18XXX instruction is 16 bit wide with many new instructions. The PIC18F458 is available in 40 pins.

Device	Program Memory		Data Memory		I/O	10-bit A/D (ch)
	Flash (bytes)	# Single-Word Instructions	SRAM (bytes)	EEPROM (bytes)		

Table 1.1 Specification of PIC18F458

2) ZCD (Zero Crossing Detector): A zero crossing detector is a comparator with the reference level set at zero. It is used for detecting the zero crossings of AC signals. It can be made from an operational amplifier with an input voltage at its positive input (see circuit diagram).When the input voltage is positive, the output voltage is a positive value, when the input voltage is negative; the output voltage is a negative value. The magnitude of the output voltage is a property of the operational amplifier and its power supply. Applications include converting an analog signal into a form suitable to use for frequency measurements, in phase locked loops, or for controlling power electronics circuits that must switch with a defined relationship to an alternating current waveform. This detector exploits the property that the instantaneous frequency of an FM wave is approximately given by where is the time difference between adjacent zero crossings of FM
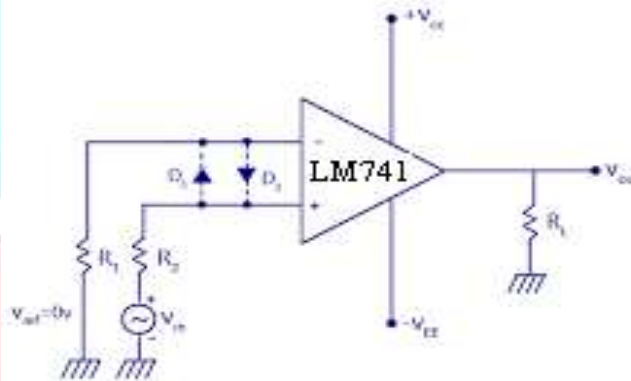

Fig 1.3 construction diagram for ZCD

3) CURRENT TO VOLTAGE CONVERTER: A current to voltage converter will produce a voltage proportional to the given current. This circuit is required if your measuring instrument is capable only of measuring voltages and you need to measure the current output. If your instrument or data acquisition module (DAQ) has an input impedance that is several orders larger than the converting resistor, a simple resistor circuit can be used to do the conversion. However, if the input impedance of your instrument is low compared to the converting resistor then the following op amp circuit should be used.
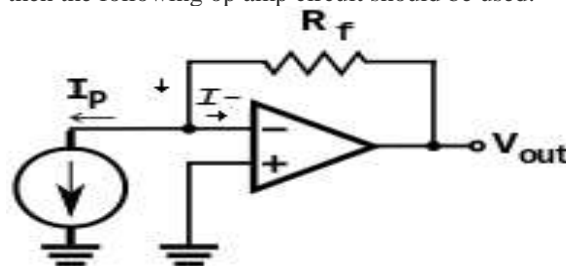

Fig: 1.4 I to V Converter

4) POTENTIAL TRANSFORMER: Potential Transformer is a transformer which is used to step down voltage. It is used to measure AC voltage by stepping down AC voltage. For example in this project, potential transformer is used to step down 220V AC voltage to 5V AC. In Potential Transformer secondary winding have less turns than primary winding. So according to below mentioned turns ratio formula, it step down AC voltage.

$$Ns/Nv = Vs/Vp$$

Voltage transformers (VT), also called potential transformers (PT), are a parallel connected type of instrument transformer. They are designed to present negligible load to the supply being measured and have an accurate voltage ratio and phase relationship to enable accurate secondary connected metering.
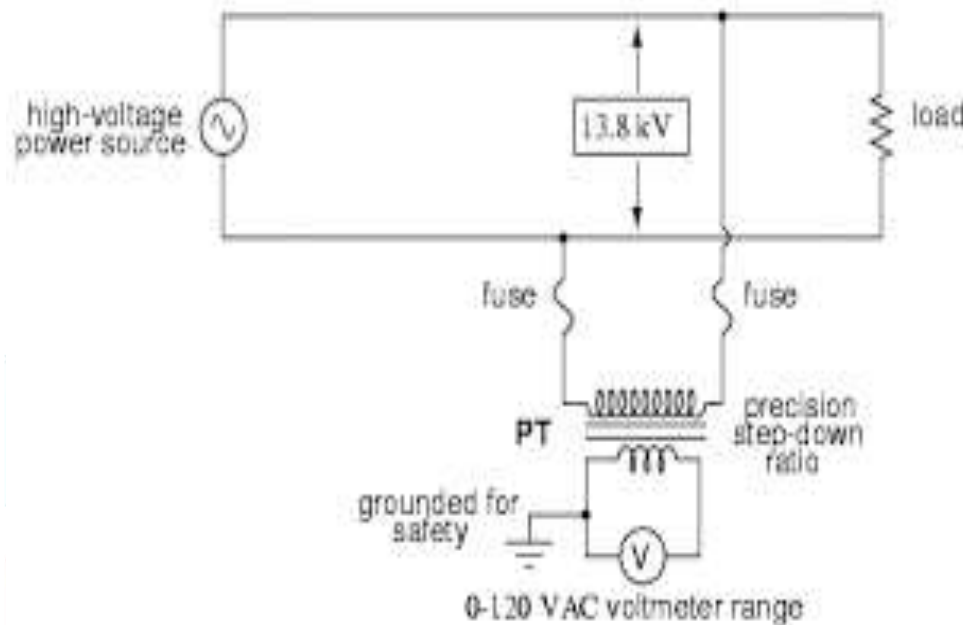
Fig: 1.5 Circuit diagram of PT

5) CURRENT TRANSFORMER: A current transformer (CT) is a transformer that is used to produce an alternating current (AC) in its secondary which is proportional to the AC current in its primary. Current transformers, together with voltage transformers (VTs) or potential transformers (PTs), which are designed for measurement, are known as instrument transformers. a current transformer is an instrument transformer, used along with measuring or protective devices, in which the secondary current is proportional to the primary current under normal conditions of operation and differs from it by an angle which is approximately zero When a current is too high to measure directly or the voltage of the circuit is too high, a current transformer can be used to provide an isolated lower current in its secondary which is proportional to the current in the primary circuit. The induced secondary current is then suitable for measuring instruments or processing in electronic equipment. Current transformers also have little effect on the primary circuit. Often, in electronic equipment, the isolation between the primary and secondary circuit is the important characteristic. Current transformers are used in electronic equipment and are widely used for metering and protective relays in the electrical power industry.
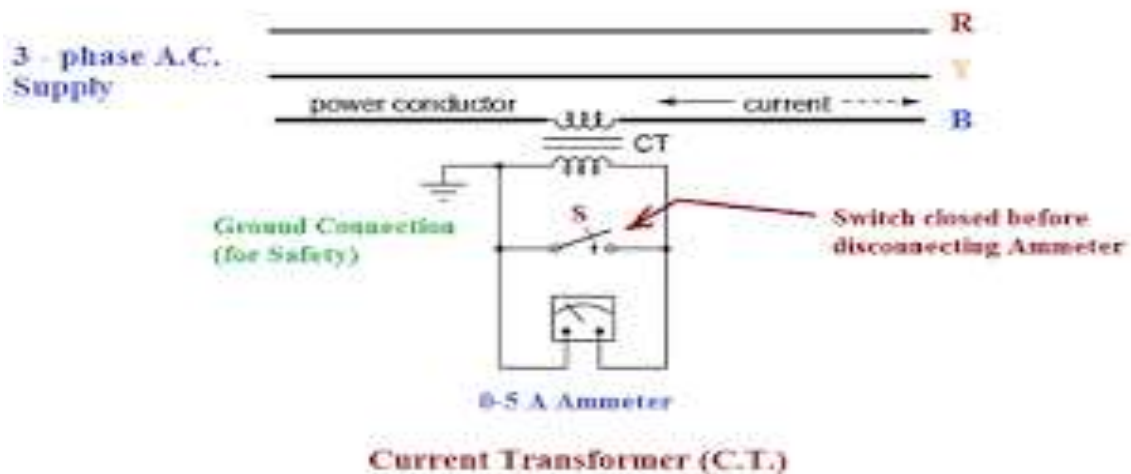
Fig 1.6 Circuit diagram of CT

6) LCD (LIQUID CRYSTAL DISPLAY): LCD (liquid crystal display) is the technology used for displays in notebook and other smaller computers. Like light-emitting diode (LED) and gas-plasma technologies, LCDs allow displays to be much thinner than cathode ray tube (CRT) technology. LCDs consume much less power than LED and gas-display displays because they work on the principle of blocking light rather than emitting it. An LCD is made with either a passive matrix or an active matrix display grid. The active matrix LCD is also known as a thin film transistor (TFT) display. The passive matrix LCD has a grid of conductors with pixels located at each intersection in the grid. A current is sent across two conductors on the grid to control the light for any pixel. An active matrix has a transistor located at each pixel intersection, requiring less current to control the luminance of a pixel. For this reason, the current in an active matrix display can be switched on and off more frequently; improving the screen refresh time (your mouse will appear to move more smoothly across the screen, for example).
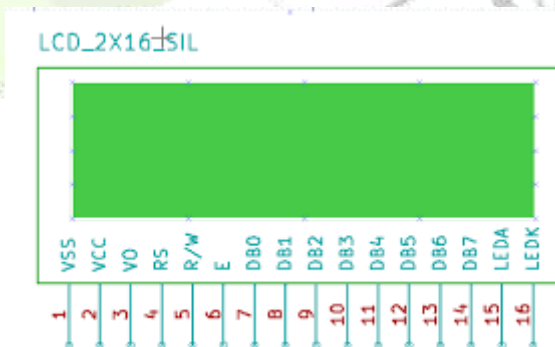

Fig1.7 Pin diagram of LCD

SOFTWARE REQUIREMENT:

Operating System   :   Windows

Software   :   PROTEUS 8.1 Professional

: Kiel

: MPLAB

: MATLAB

: Dot Net

ADVANTAGES:

1) Simple in construction.
2) Cheap in cost.
3) Real time data can be monitored.
4) Continuous data can be stored and read as per requirement in future.
5) It can be used for domestic as well as small scale industries.

DISADVATAGES:

1) It cannot be used for large scale industries.
2) Only limited data can be monitored.

APPLICATION:

1) Measurement of active power
2) Measurement of reactive power
3) Measurement of power factor
4) Power factor correction
5) Reactive power compensation
6) Storage of data

IV. RESULTS

Designer a good PIC18F458 microcontroller based power factor correction devices to help improve power factor, reduced high current flow through the system and also reduced harmonics in the system. Improving the efficiency of the system and reducing high electricity cost.it is applicable on commercial and residential system. The. The technique presented in this presentation provides a very simple method for the digital measurement of active and reactive power. This technique can be implemented in the various fields of industry. The circuit is designed to display active and reactive power of the load connected the network. Calculation process is achieved by PIC18F458. The system can be tested under different loading conditions using PROTEUS and MATLAB simulator has shown linear behavior under those conditions.

I. ACKNOWLEDGMENT

REFERENCES

[1] Banks, w., and majithia, j.c., 1976, microprocessors: design and applications in digital instrumentation and control. Ieee trans. On instrumentation and measurement, im-25, no. 3.

[2] filipski, p., 1980, a new approach to reactive current and reactive power measurement in nonsinusoidal systems. Ieee trans. On instrument and measurement, im-29, no.4.

[3] hafeth, b. A., and abdul-karim, a. H., 1984, digital power meter using non-linear adc. International journal of electronics, 57,179-186.

[4] ibrahim, k. M., and abdul-karim, a. H., 1984, a novel phase measurement method. International journal of electronics, 56, 217-221.

[5] prokik, d., 1986, a concept for measurement of electric power on the basis of mass measurement, rev. Roum. Phys. Tome, 31, 275-279.

[6] fatih b., and omer f. H., 2010, microcontroller-controlled reactive power measurement and saving circuit design for residences and small scale enterprises, scientific research and essays vol. 5(16), pp. 2312-2317.

[7] Microchip 2001, pic 16f87x data sheet, usa.

[8] Basil a., 2012, alerting system design using pic16f877a for power distribution system, the 4th international engineering conference –towards engineering of 21st century.

[9] Rectifier", *concise encyclopeSSdia of science and technology*, third edition, sybil p. Parker, ed. Mcgraw-hill, inc., 1994, p. 1589