Intelligent Industrial Digital Library for Measurement of Capacitor Parameter

Mr. Suresh Y. Sankpal, Dr. Mrs. S. B. Patil, Mr. Abhijeet Shete

Abstract— The Capacitors are used in power systems. Manufacturing process of capacitor is carried out in the industry. The objective of our system is to measure various parameter of capacitor while manual testing process is going on. The exact value of test parameter detected automatically and sent to the control room so that faults in the manual testing process is identified. In all, developed system generate a list of all the parameter detected automatically. Retain the same in computer so that it can be compared with standard values.**Industrial Digital Library is sponsored by Sharada Electronics Pvt Ltd,Miraj MIDC.**

Index Terms—Industrial library parameter, digital library, capacitor, temperature process, impregnatipion plant. Microcontroller, LCD interfacing, signal conditioning, AC and DC voltage.

1 Introduction

In recent years the nature of load has changed drastically and different electrical machinery i.e. mercury lamps, transformers, motors, switchgears are running inherently at low power factor. This means that power supply authorities have to generate much more current that is theoretically required. This high current level in our system needs to be reduced [1]. This includes different techniques such as improving power factor, changing conductor size, substituting cables with conductors etc. For that capacitor banks are mainly installed to provide capacitive reactive compensation/ power factor correction [3]. Capacitors are used to improve the quality of the electrical supply and the efficient operation of the power system.

The aim of this paper is to present partly the Digital Library of an Power Capacitor Development. The main role of the Library is to facilitate the Power capacitor research and development, through the automation of the related measurement tasks, and to provide a powerful database system background for data retrieval and research decision support. The paper introduces only a few applications of the entire system. Different Power capacitor measurements were automated. All the measurements have been implemented in a similar manner. During the process the user initializes the measurement, sets the measurement environmental parameters, and launches the execution. The program runs on its own, sending automatically the results of the measurement to a database system, from where the data can be retrieved in a predefined or a non-predefined way. For the realization of the above requirements the equipments in the industry, data acquisition and PROTEUS software development tools were chosen as implementation purpose.

2 Industrial Library

2.1 Capacitor

Capacitors play a very important role in our world. They can be found in every electronic device around us, they are widespread all over the world used as energy storage elements, filters and decouplers. The main features of capacitors are: capacity (1pF-1F), operational voltage (from 1,5 V up to some kV), operational temperature (from -55 °C to 125 °C), loss factor, size and shape. The most frequently used capacitor types in the industry nowadays are: ceramic, foil, aluminium and tantalum capacitors.

The four most important application fields for capacitor technologies are radio techniques, electrical power processing, energy storage and power electronics. Except for the first application field electrolyte-capacitors can be used, so this type of capacitor is prevalent. The main advantage of the electrolytic capacitors is the high capacity and voltage value, which can be attributed to the dielectric layer with very small thickness, but with very large surface. Their disadvantage is the over voltage sensitivity. The main characteristics of the electrolytic capacitors are determined by the electrolyte, the anode foil and the paper separator. [6]

The electrolyte generally consists of the following components:

- solvent: e.g.: ethylene glycol,
- acids and bases: usually organic,
- different additives

The electrolytes are characterized by two major features: conductivity and breakdown potential, both of them dependent on the temperature. The change of conductivity as a function of temperature decisively affects the electric parameters of the capacitor. The chemical reactions, which take place inside the electrolyte, are in direct relationship with the conductivity value at different temperatures and the quantification of this relationship is important. The conductivity and breakdown potential of the electrolyte influences the maximum operating condition of the capacitors. breakdown potential, both of them dependent on the temperature. The change of conductivity as a function of temperature decisively affects the electric parameters of the capacitor. The chemical reactions, which take place inside the electrolyte, are in direct relationship with the conductivity value at different temperatures and the quantification of this relationship is important.

3 HARDWARE DISCRIPTION

3.1 Introduction of Praposed work

The main objective of 'Digital Library' is use of monitoring different parameters in manufacturing industry so as to reduce need for human sensory and mental requirements as well. However the concept only became truly practical with the addition of the digital computer, whose flexibility allowed it to drive almost any sort of task. Basic Schematic diagram of the proposed work is shown in **figure 1**

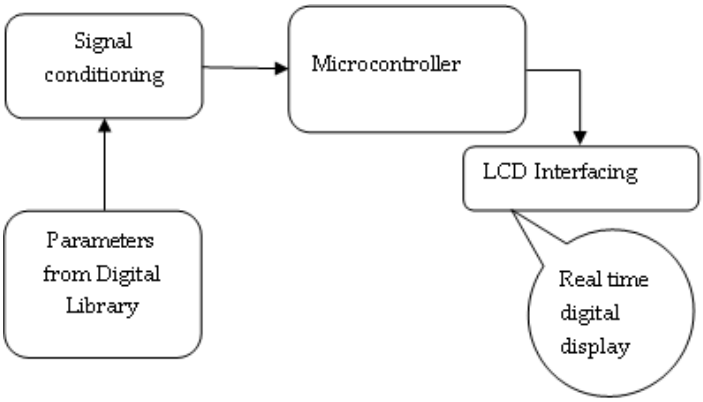

Figure 1 : Proposed Work

3.2 Capacitor

3.2.1 Winding

Power Capacitor Contains several elements which are wound by winding two layers of aluminium foil interleaved by many layers of PP film having extended foil construction. The aluminium foil winding is Edge folded throughout the length of winding and also end folding at the beginning and end of the winding. The ideal manufacturing condition involve the use of temperature Control & filtered Air Conditioning system in which environment of winding is free from dust ,moisture etc.

3.2.2 Element testing :

The winding elements are individually inspected and tested before being send in batches to the processing area. Dry element testing is necessary to confirm the voltage withstand capacity, design parameters etc.

3.2.3 Element pack assembly :

No. of elements are packed together in series / parallel group separated by insulating paper as per design. This pack is pressed on pneumatic press under desired pressure and Firmly held by insulating strips.

3.2.4 Soldering, connection, wrapping :

The extended portion of the elements is soldered with special soldering material by special type of gas flame gun on both sides of pack of specific width. The connection terminals, discharge resistors plate fitting, paper insulation wrapping is done. The insulation level shall be strictly observed while wrapping to avoid terminal to body breakdown. This dry pack is tested for DC voltage. Its capacitance value is measured to confirm the design requirement. This pack is housed in sheet steel container fitted with leads upon which are mounted in two porcelain bushings. The small hole is kept open on top plate for pre drying and impregnation.

3.2.5 Impregnation

The next important process is Vacuum drying and impregnation of capacitors. The Container assembled winding packs are loaded in impregnation chamber. When they are dried under elevated temp.and vacuum, then impregnating fluid is filtered taken through vacuum dehydrating and degassing processes before it passes, still under vacuum to the impregnation chamber. After impregnation the capacitors are left for soaking for a specific period. Then capacitors are unloaded. This impregnation process is the heart of capacitor manufacturing.
The electrolyte is now added to the assembly by a process called "impregnation." The method of impregnation requires the wound element to be immersed into the electrolyte by a vacuum/pressure cycle either with or without applied heat or simple absorption. The electrolyte contains a solvent such as ethylene glycol and a solute such as ammonium borate. Should the dielectric film be damaged, the presence of the electrolyte will allow the capacitor to heal itself by forming more oxide. By selecting different electrolytes, capacitor characteristics such as operating temperature range, frequency response, shelf life, and load life, can be further improved

3.2.6 Electrical testing

After completing the impregnation processes each & every capacitor is tested for leakage check at elevated temp. in the chamber. After that capacitor are electrically tested as per IS & IEC Specification to ensure the design data, Quality Parameters etc.

The routine tests and type tests are carried out but The most important parameter of the capacitor is its AC and DC voltage. It is Essential to withstand the capacitor to AC and DC voltage as per rating. Monitoring of such voltages are considered and finally send to control room for evaluation.

3.2.7 Painting

Successfully passing through final electrical testing and Quality Control parameters capacitors are painted with a special primer and then epoxy painting.

3.2.8 Finishing

After completing these processes and finishing with other accessories like Name plate, Nut Bolts, the Capacitors will be ready for dispatch.

This is the manufacturing process of the power capacitor and to implement our system in this industry so that productivity is increased and to find out the faults on real time parameters.

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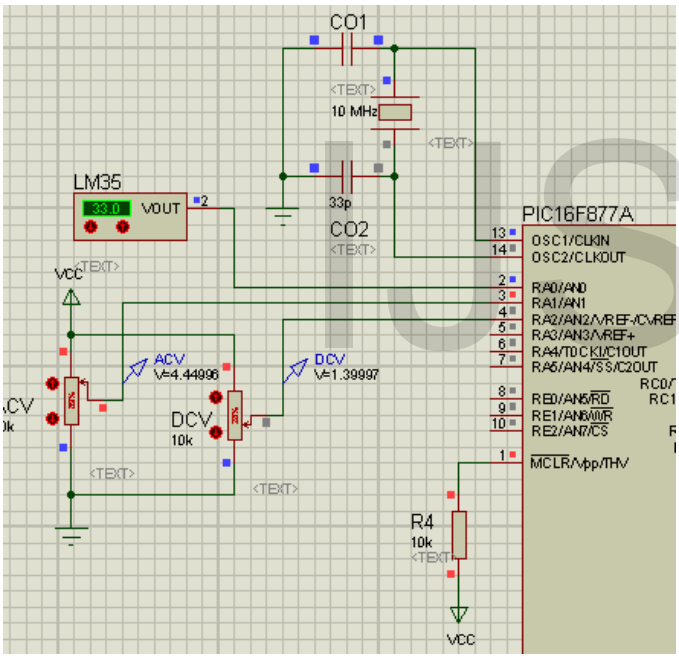
3.3 Signal Conditioning

Signal conditioning is either amplification, attenuation, isolation, filtering or excitation of signal. Many applications require environment or structural measurements, such as temperature and vibration, from sensors. These sensors, in turn, require signal conditioning before a data acquisition device can effectively and accurately measure the signal. Key signal conditioning technologies provide distinct enhancements to both the performance and accuracy of data acquisition systems. Temperature, all the voltages measured are considered in the signal conditioning.

It means that manipulating an analog signal in such a way that it meets the requirements of the next stage for further processing. The most common use is analog to digital conversion followed by signal conditioning. But here PIC microcontroller is used in this system so it is having on chip analog to digital conversion facility therefore ADC is not necessarily used.

Figure 2 : Signal Conditioning for Capacitor Parameter



4 Figure Flow

As demonstrated in this figure 1, all the parameters from the digital library are collected and applied to PIC microcontroller. PIC microcontrollers (Programmable Interface Controllers), are electronic circuits that can be programmed to carry out a vast range of tasks. They can be programmed to be timers or to control a production line and much more.

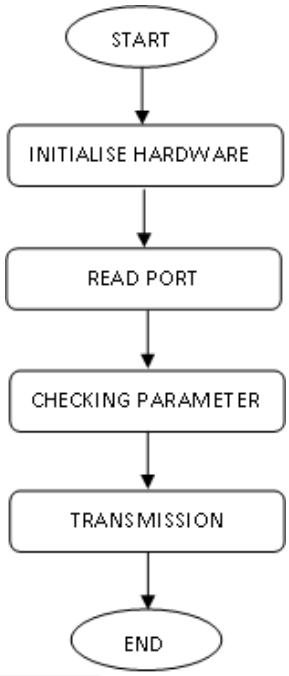
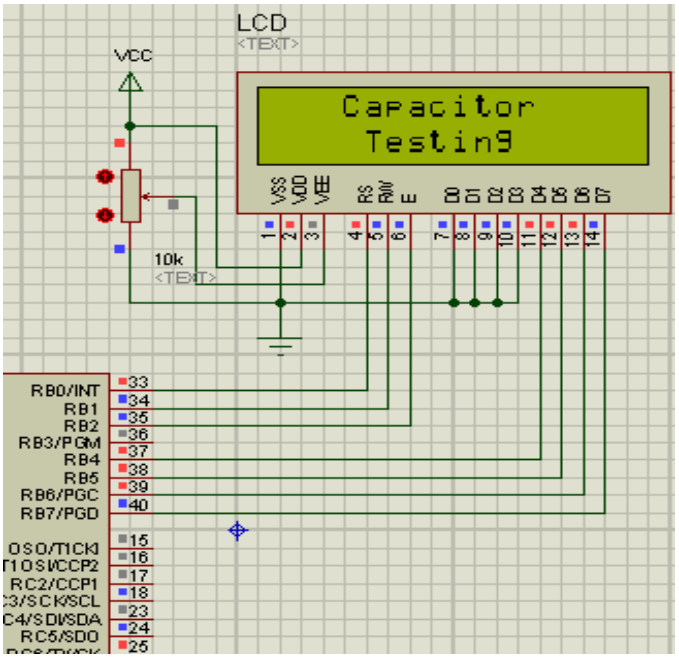


Figure 3: Flow Chart

5 Simulation Result

5.1 System Initialization

Figure 4 : LCD Initialization



5.2 System Real Time Parameter

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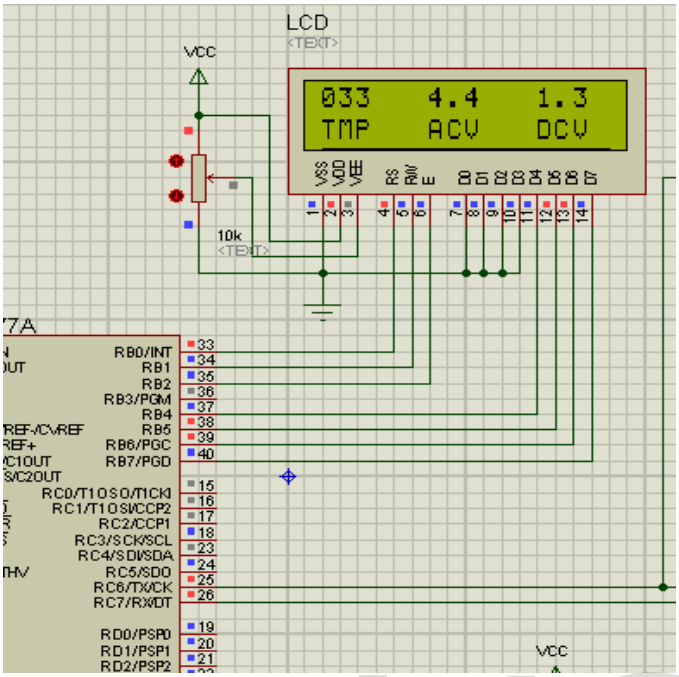

Figure 5 :System real time parameter

6 CONCLUSION

The digital library is a system or design formed for a particular task to know the current status of any device. Basically there are many more devices are available with this digital library. If one wants to find out the status generated by this particular device in a real time so that it is possible to measure real time parameter associated with this system.

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