A
Project Report On

DISTRIBUTION TRANSFORMER: MONITORING & PROTECTION

Submitted By

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Submitted as a partial fulfillment of

Bachelor of Engineering
B.E. (Semester VIII), ELECTRICAL
[2014-2015]
From

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KALSEKAR TECHNICAL
CAMPUS, SCHOOL OF
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NEW PANVEL, NAVI MUMBAI-
410206
(UNIVERSITY OF MUMBAI)
Academic Year 2014-2015

DECLARATION

I hereby declare that the project "DISTRIBUTION TRANSFORMER: MONITORING & PROTECTION" submitted for Bachelor of Engineering in Electrical Engineering under Mumbai University, is my original work and the project has not formed the basis for the award of any degree, association, fellowship or any other similar titles.

Signature of the Student:

Place:

Date:

ANJUMAN-I-ISLAM'S

KALSEKAR TECHNICAL CAMPUS, PANVEL

DEPARMENT OF ELECTRICAL ENGINEERING

CERTIFICATE

THIS IS TO CERTIFY THAT **MR. AJAY SHANKAR GUJARI, MR.BELAL AHMAD, MR.FARHAN KHAN, MR.IMTIYAZ SHAIKH, MR. SAMEEP SWAMY,** A STUDENT OF VIIITH SEMESTER**BACHELOROF ENGINEERING IN ELECTRICAL ENGINEERING**, HAVE SUCCESSFULLY COMPLETED AND SUBMITTED HIS PROJECT WORK DURING THE ACADEMIC YEAR 2014-2015 TITLED AS**: DISTRIBUTION TRANSFORMER: MONITORING & PROTECTION**FOR KALSEKAR TECHNICAL CAMPUS, PANVEL STIPULATED IN THE SYLLABUS FOR THE AWARD OF BACHELOR OF ENGINEERING IN ELECTRICAL ENGINEERING **BY MUMBAIUNIVERSITY.**

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ACKNOWLEDGEMENT

We take this opportunity to express our deep sense of gratitude to our guide **Prof. RIZWAN FARADE** for his valuable guidance and inspiration in spite of his busy schedule. He devoted himself in completing our task with the admirable excellence. He has taken keep and personal interest in giving us constant encouragement and timely suggestions also to our HOD **Prof. SAYED KALEEM** for cheerful encouragement and notable guidance.

Our special thanks to our electrical staff, who gave precious guidelines for our paper **DISTRIBUTION TRANSFORMER: MONITORING & PROTECTION**supporting staff members of electrical department for their valuable help in our paper.

We also express our heart full thanks to our beloved Principal **Dr. ABDUL RAZZAK HONNUTAGI**has provided the facilities for paper, we are also thankful to our friends.

ABSTRACT

The basic aim of our project is to protect the transformer against internal faults and ensuring security of the protection scheme for external faults. System conditions that indirectly affect transformers often receive less emphasis when transformer protection is specified. Overloading power transformers beyond the nameplate rating can cause a rise in temperature of both transformer oil and windings. If the winding temperature rise exceeds the transformer limits, the insulation will deteriorate and may fail prematurely.

Prolonged thermal heating weakens the insulation over time, resulting in accelerated transformer loss-of-life. Power system faults external to the transformer zone can cause high levels of current flowing through the transformer. Through-fault currents create forces within the transformer that can eventually weaken the winding integrity. A comprehensive transformer protection scheme needs to include protection against transformer overload, through-fault, and over excitation, as well as protection for internal faults. This paper focuses on liquid-immersed transformers because the majority of medium and high-voltage transformers are of this type.

If there is a fault in the transformer, by our project we can detect the fault in the transformer and there will be notification to the control room regarding the fault.

PROJECT IDEA

This project is intended to achieve the following:

- To detect the fault occurred in the transformer.
- To notify the fault to the control room and take preventive measure to remove the fault.
- To provide uninterrupted power supply to consumers.

OBJECTIVES

- To help the distributor companies to provide
- Uninterrupted power supplies to consumers.
- To protect distribution transformer witheconomical method.

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CHAPTER 1: INTRODUCTION

Electricity is an important element for industrial growth & social development. Now-a-days manual network planning & operation executed manually for maintaining continuity & quality of electric supply have become a time consuming process. The consumers' expectations for quality reliability of supply have gone up. With increasing pace of liberalization, particularly with the private sectors, so that electricity will no more be monopoly of public sector.

The transformers are one of the static devices which are used in the distribution network. To have a control over the densely distributed transformers, protection & signaling is a important factor. There are several methods of protecting transformer. While keeping pace with the development in the field & meeting the utilities also have to lower operating cost & a great efficient circuit. So, we are introducing signaling system. Communication system is the backbone of DTPS (Distribution Transformer Protection & Signaling) system.

Transformers of various size and configuration are applied throughout the power system. These transformers play an important role in power delivery and the integrity of the power system network as a whole. Power transformers have operating limits beyond which transformer loss of life can occur. This paper examines the adverse conditions to which a power transformer might be subjected.

Our project includes transformer overload, voltage fluctuation and over temperature protection. We discuss each operating condition and its effect on the power transformer, and provide a solution in the protection scheme for each operating condition. Distribution transformer control &signaling system is conceptualized topic as automatic control of electrical network. Today there is rapidincrease in consumer needs which increases their status. As our country trying to turn towards developed country, people needs also increases in parallel to this their demand for electrical energy is also increases. As demand increases complexity also increases.

In our project "Distribution transformer and its protection system" our main objective is to provide uninterrupted power supply to consumers & also protect our transformer .We know that power transformers in receiving end station are totally protected with SCADA system andother protective means. Instead of the use of SCADA system by the distributor companies, many distribution transformers are set to fire due to high temperature faults. And it is not possible for companies to inspect all transformers 4050 & 1700 weekly, monthly & yearly. So, by using DTPS system we can take the instantaneous reading & signaling, when fault is going to occur.

In general, the main concern with transformer protection is protecting the transformer against internal faults and ensuring security of the protection scheme for external faults. System conditions that indirectly affect transformers often receive less emphasis when transformer protection is specified. Overloading power transformers beyond the nameplate rating can cause a rise in temperature of both transformer oil and windings. If the winding temperature rise exceeds the transformer limits, the insulation will deteriorate and may fail prematurely.

Prolonged thermal heating weakens the insulation over time, resulting in accelerated transformer loss-of-life. Power system faults external to the transformer zone can cause high levels of current flowing through the transformer. Through-fault currents create forces within the transformer that can eventually weaken the winding integrity. A comprehensive transformer protection scheme needs to include protection against transformer overload, through-fault, and over-excitation, as well as protection for internal faults. This project focuses on liquid-immersed transformers because the majority of medium and high-voltage transformers are of this type.

1.1 Transformer Categories

Category Single Phase KVA Three Phase KVA

I. 5 to 500 &15 to 500

II. 501 to 1667&501 to 5000

III. 1668 to 10000& 5001 to 30000

IV. Above 10000& Above 30000

To provide a more comprehensive representation of the long-term effects of system conditions on power transformers, each category includes through-fault capability limits, which are a function of the maximum current through the transformer.

The maximum current (in per unit [p.u.] of the transformer base rating) is calculated based on the transformer short-circuit impedance for category I and II transformers. Maximum current calculation for category III and IV transformers is based on the overall impedance of the transformer short-circuit impedance and the system impedance.

1.1.1 Category I Transformers

The curve reflects both thermal and mechanical considerations. For short-circuit currents at 25–40 times the base current, the I2t limit of 1250 defines the curve, where I is the symmetrical fault current in multiples of the transformer base current and t is in seconds. Current (I) is based on the transformer's per-unit short circuit impedance. A transformer with 4 percent impedance will have a maximum short circuit current of 25 p.u. (1/0.04), which results in a time of 2 seconds (1250/252) for its through fault capability limit.

1.1.2 Category II and III Transformers

For Category II and III transformers, the IEEE standard provides an additional through-fault capability limit curve. The additional curve takes into account the fault frequency that the transformer is subjected to throughout its entire life. In general, use a frequent-fault curve if fault frequency is higher than ten through-faults for category II transformers and higher than five through-faults for category III transformers. Fault frequency is considered over the life of the transformer.

Fig. 2 represents the through-fault capability limit curve for category II and III transformers that experience infrequent faults. The curve is limited to two seconds.

To acknowledge the cumulative nature of damage caused by through-faults, the standard supplements the through-fault capability limit curve to reflect mechanical damage. It calculates the I2t curve based on the actual transformer impedance.

For category II transformers, consider the mechanical duty for fault currents higher than 70 percent of maximum possible short-circuit current. For category III and IV transformers, consider mechanical duty for through-fault currents higher than 50 percent of maximum possible short-circuit current.

1.2 Protection Consideration

After determining the proper through-fault capability limit curve for a particular transformer, select a time-over current characteristic to coordinate with the through-fault capability limit curve. In distribution transformer applications where a number of feeders are connected to the low-voltage bus, the feeder relays become the first line of defense. IEEE Standard C37.91 recommends [3] setting the inverse time-over current characteristic of the feeder relays to coordinate with the through-fault capability limit curve of the transformer, as shown in Fig. 5.

Coordinating an over current element with an I2t thermal element requires further consideration. Although the extremely inverse time-over correct characteristic of the over current relay seems to emulate the shape of the thermal curve, the coordination is only valid for a fixed initial over current condition [4]. Once an overload or through-fault condition causes the transformer winding temperature to rise, coordination between the over current relay and the thermal element is no longer valid. In this situation, the over current relay does not prevent thermal damage caused by cyclic overloads.

1.2.1 Transformer Overload

For this paper, we define over current as current flowing through the transformer resulting from faults on the power system. Fault currents that do not include ground are generally in excess of four times full-load current; fault currents that include ground can be below the full-load current depending on the system grounding method. Over current conditions are typically short in duration (less than two seconds) because protection relays usually operate to isolate the faults from the power system.

Overload, by contrast, is current drawn by load, a load current in excess of the transformer nameplate rating. IEEE standard [5] lists nine risks when loading large transformers beyond nameplate ratings. In summary, loading large power transformers beyond nameplate ratings can result in reduced dielectric integrity, thermal runaway condition (extreme case) of the contacts of the tap changer, and reduced mechanical strength in insulation of conductors and the transformer structure. Three factors, namely water, oxygen, and heat, determine the insulation

(cellulose) life of a transformer. Filters and other oil preservation systems control the water and oxygen content in the insulation, but heat is essentially a function of the ambient temperature and the load current. Current increases the hottest-spot temperature (and the oil temperature), and thereby decreases the insulation life span.

1.2.2 Ambient Temperature

Excessive load current alone may not result in damage to the transformer if the absolute temperature of the windings and transformer oil remains within specified limits. Transformer ratings are based on a 24-hour average ambient temperature of 30°C (86°F). Note that the ambient temperature is the air in contact with the radiators or heat exchangers. Table II shows the increase or decrease from rated KVA for other than average daily ambient temperature of 30°C. C. Thermal Models Including Ambient Temperature More sophisticated transformer thermal models [5] use load current as well as the ambient temperature to calculate Top-Oil temperature and hottest-spot temperature. To calculate the absolute Top-Oil temperature and hottest spot temperature, the model adds the calculated Top-Oil and hottest-spot temperatures to the measured ambient temperature (subtract for a temperature drop).

When the ambient temperature is not available, or communication with the device that supplies the ambient temperature information is lost, the thermal model uses a fixed value as reference for the ambient temperature. However, using a fixed value instead of the actual ambient temperature as reference means that the model cannot indicate whether actual damage will occur at any particular level of overload.

1.2.3 Thermal Models Excluding Ambient Temperature

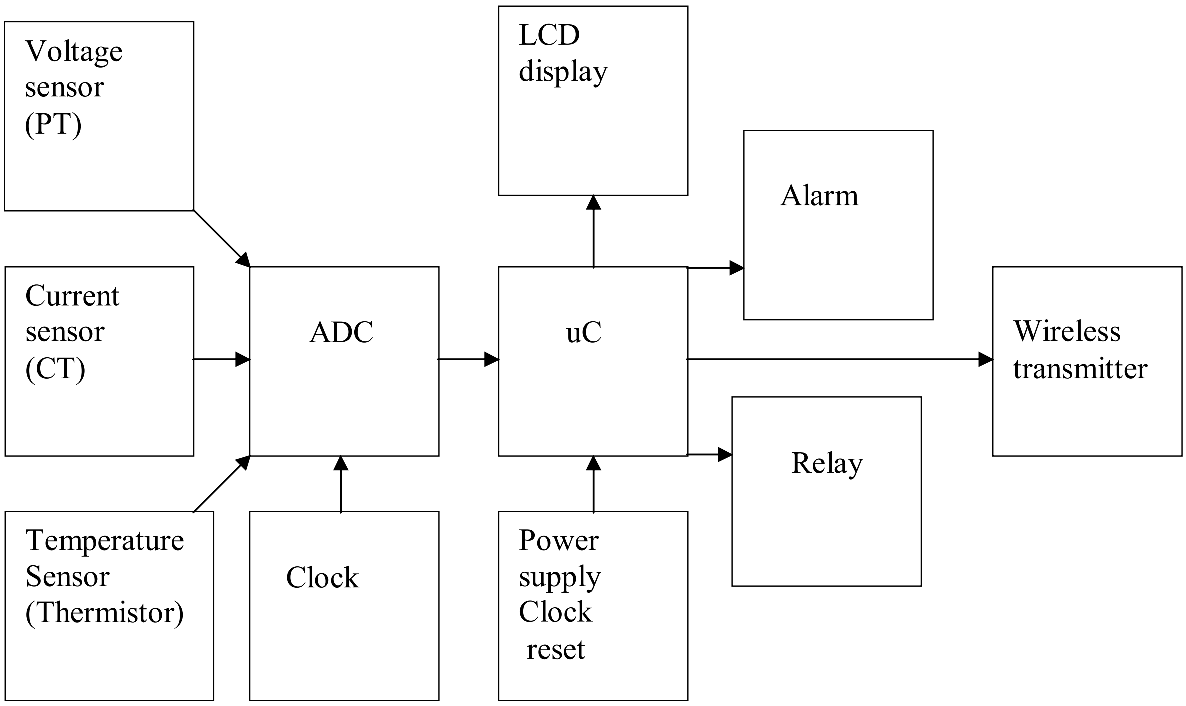
Although less accurate, models without direct ambient temperature can still provide useful information as to the temperature rise of the transformer oil when constant current flows. These models project the temperature rise within the transformer as a function of (constant) load current flowing though the transformer. For example, looking at the manufacturers' literature, we see that a hypothetical transformer has a time constant (TC) of one hour. Using Equation (3), we calculate that the transformer will reach steady-state temperature after five hours (five time constants) when constant full-load current flows.

1.2.4 Transformer Over-excitation

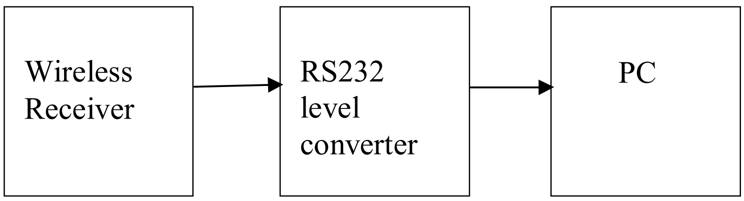
The flux in the transformer core is directly proportional to the applied voltage and inversely proportional to the frequency. Over excitation can occur when the per-unit ratio of voltage to frequency (Volts/Hz) exceeds 1.05 p.u.at full load and 1.10p.u.at no load. An increase in transformer terminal voltage or a decrease in frequency will result in an increase in the flux. Over excitation results in excess flux, which causes transformer heating and increases exciting current, noise, and vibration.

CHAPTER 2: BLOCKDIAGRAM

2.1 Block diagram of Monitoring system



2.2 Block diagram of control room section



2.3 Block Diagram Description

The sensor selection had to be based upon three factors, economy, usability, and modularity.

2.3.1 Sensor

A sensor is a physical device or biological organ that detects, or *senses*, a signal or physical condition and chemical compounds.

2.3.1.1 Overview

Most sensors are electrical or electronic, although other types exist. A sensor is a type of transducer. Sensors are either direct indicating (e.g. a mercury thermometer or electrical meter) or are paired with an indicator (perhaps indirectly through an analog to digital converter, a computer and a display) so that the value sensed becomes human readable. In addition to other applications, sensors are heavily used in medicine, industry and robotics. Technical progress allows more and more sensors to be manufactured with MEMS technology. In most cases this offers the potential to reach a much higher sensitivity. See also MEMS sensor generations.

2.3.1.2 Types of sensors

Since a significant change involves an exchange of energy, sensors can be classified according to the type of energy transfer that they detect. Thermal sensors temperature sensors: thermometers, thermocouples, temperature sensitive resistors (thermistors and resistance temperature detectors), bi-metal thermometers and thermostatsheat sensors: bolometer, calorimeter.

2.3.1.3 Electromagnetic sensors

Electrical resistance sensors: ohmmeter, multimeter

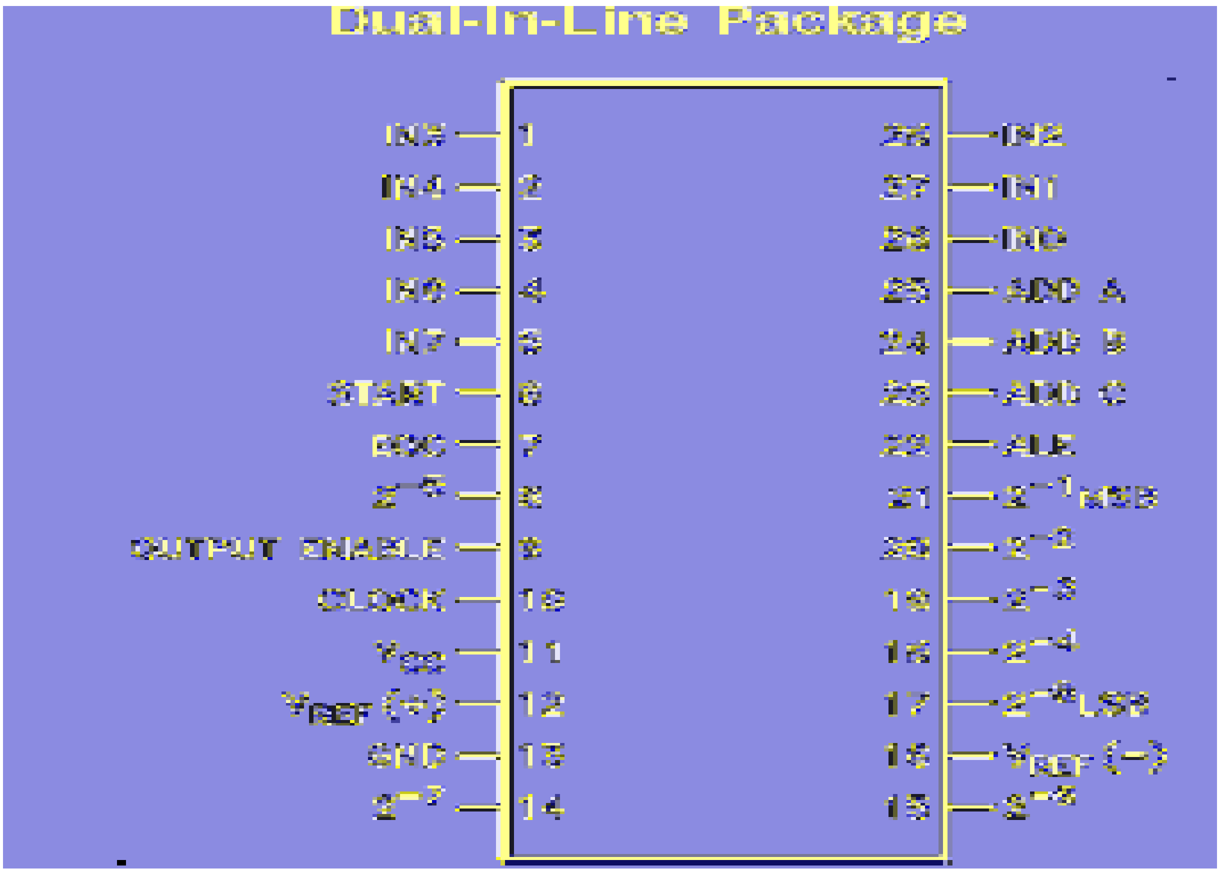
Electrical current sensors: galvanometer, ammeter

Electrical voltage sensors: leaf electroscope, voltmeter

Electrical power sensors: watt-hour meters

2.4 ADC0808/ADC0809 of National Semiconductor (8-Bit µP Compatible A/D Converters with 8-Channel Multiplexer)

The ADC0808, ADC0809 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.



2.5 DISPLAY

Various display device such as seven segment display. LCD display, etc can be interfaced with microcontroller to read the output directly. In our project we use a two line LCD display with 16 characters each.

2.5.1 LCD

Liquid crystal Display (LCD) displays temperature of the measured element, which is calculated by the microcontroller. CMOS technology makes the device ideal for application in hand held, portable and other battery instruction with low power consumption.

2.5.2 GENERAL SPECIFICATION:

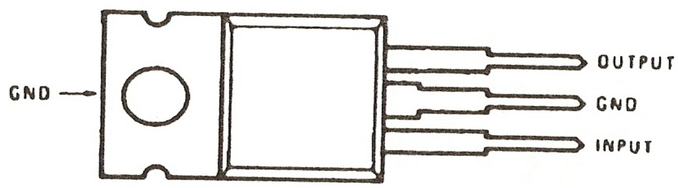
- Drive method: 1/16 duty cycle
- Display size: 16 character * 2 lines
- Character structure: 5*8 dots.
- Display data RAM: 80 characters (80*8 bits)
- Character generate ROM: 192 characters
- Character generate RAM: 8 characters (64*8 bits)
- Both display data and character generator RAMs can be read from MPU.
- Internal automatic reset circuit at power ON.
- Built in oscillator circuit.

2.5.3 Net Media 2x16 Serial LCD Display Module

2.6 VOLTAGE REGULATOR

A voltage regulator is an electricalregulator designed to automatically maintain a constant voltage level. It may use an electromechanical mechanism, or passive or active electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages. With the exception of shunt regulators, all voltage regulators operate by comparing the actual output voltage to some internal fixed reference voltage. Any difference is amplified and used to control the regulation element. This forms a negative feedbackservo control loop. If the output voltage is too low, the regulation element is commanded to produce a higher voltage. If the output voltage is too high, the regulation element is commanded to produce a lower voltage. In this way, the output voltage is held roughly constant.

Plastic Package
TO-220 (T)



Top View

Order Number LM7805CT,
LM7812CT or LM7815CT
See NS Package Number T03B

2.7 MIROCONTROLLER

Introduction to Microcontrollers

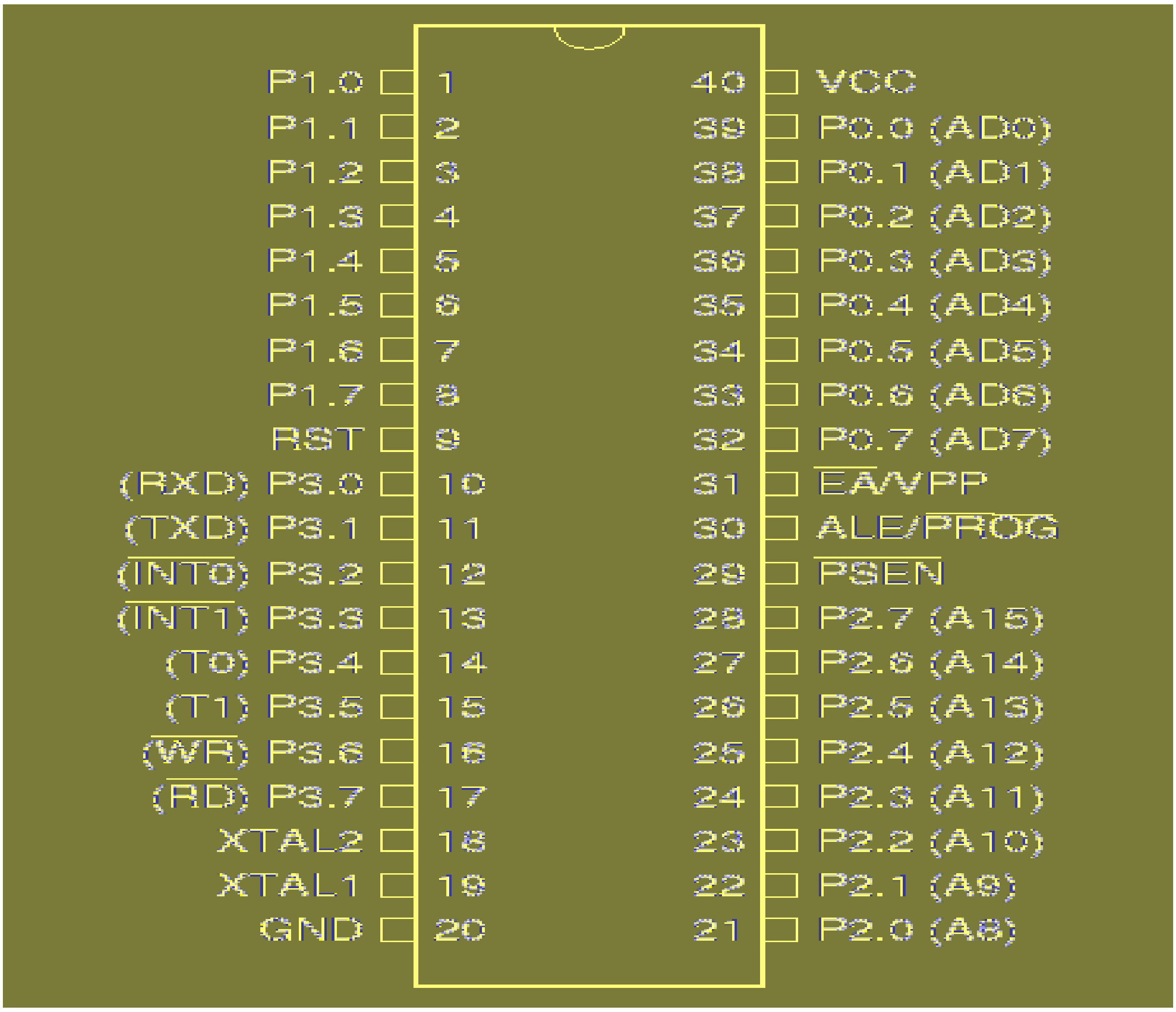
An embedded microcontroller is a chip which has a computer processor with all its support functions (clock & reset), memory (both program and data), and I/O (including bus interface) built into the device. These built in functions minimize the need for external circuits and devices to be designed in the final application.

2.7.1 The 89C51 microcontroller

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Phillips's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. 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 Flash on a monolithic chip, the Phillips AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89C51 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 Hardware reset.

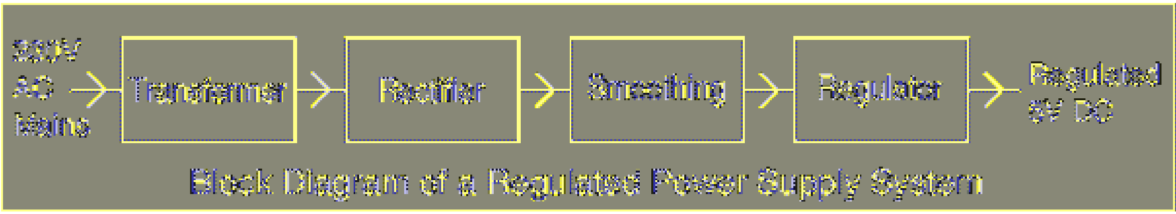
2.7.2 Pin Diagram of 89C51



2.8 Power Supply

There are many types of power supply. Most are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function.

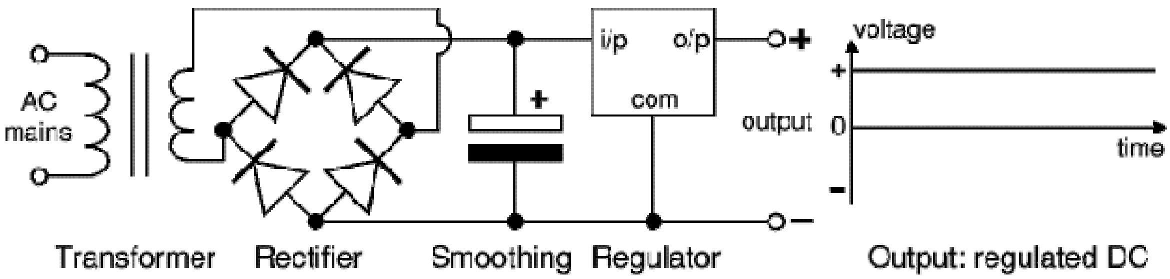
For example a 5V regulated supply:



Each of the blocks is described in more detail below:

- Transformer - steps down high voltage AC mains to low voltage AC.
- Rectifier - converts AC to DC, but the DC output is varying.
- Smoothing - smoothes the DC from varying greatly to a small ripple.
- Regulator - eliminates ripple by setting DC output to a fixed voltage.

Transformer + Rectifier + Smoothing + Regulator



The **regulated DC** output is very smooth with no ripple. It is suitable for all electronic circuits. The fig. above shows the circuit diagram of the power supply unit. This block mainly consists of a two regulating IC 7805 and a bridge rectified and it provides a regulated supply approximately 5V.

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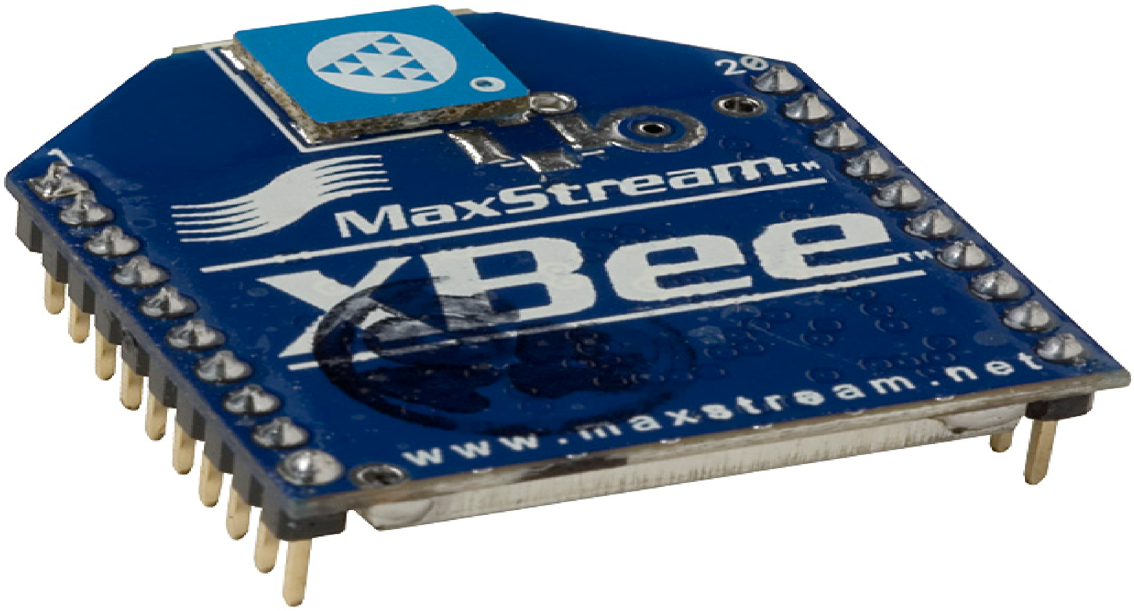
2.9 Zigbee Transmitter Receiver Module



ZigBee was created to address the market need for a cost-effective, standards-based wireless networking solution that supports low data-rates, low-power consumption, security, and reliability. ZigBee is the only standards-based technology that addresses the unique needs of most remote monitoring and control and sensory network applications.

The initial markets for the ZigBee Alliance include Consumer Electronics, Energy Management and Efficiency, Health Care, Home Automation, Building Automation and Industrial Automation.

Many silicon manufacturers are currently taking advantage of the features and popularity of ZigBee. This article surveys the devices currently on the market, the advantages and disadvantages of each, and provides a simple, unbiased, side by side comparison of the available silicon. This comparison is aimed at helping a newcomer to ZigBee select a device that will be suitable for their application.

2.9.1 The ZigBee Advantage

The ZigBee protocol was designed to carry data through the hostile RF environments that routinely exist in commercial and industrial applications.

2.9.2 ZigBee protocol features:

- Low duty cycle - Provides long battery life
- Low latency
- Support for multiple network topologies: Static, dynamic, star and mesh
- Direct Sequence Spread Spectrum (DSSS)
- Up to 65,000 nodes on a network
- 128-bit AES encryption – Provides secure connections between devices
- Collision avoidance
- Link quality indication
- Clear channel assessment
- Retries and acknowledgements
- Support for guaranteed time slots and packet freshness

2.9.3 Secure Connections

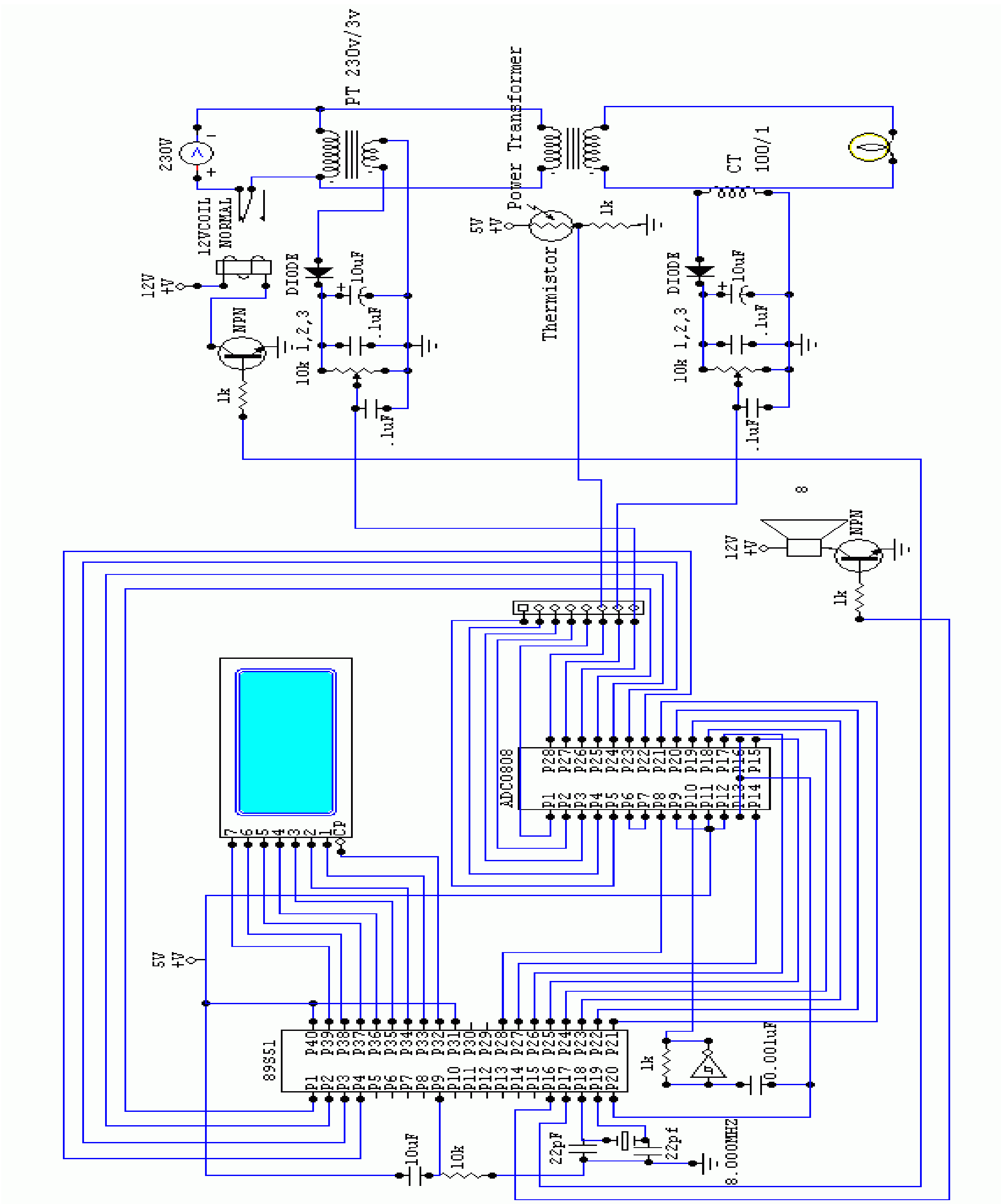
The ZigBee specification provides a security toolbox approach to ensuring reliable and secure networks. Access control lists, packet freshness timers and 128-bit encryption based on the NIST Certified Advanced Encryption Standard (AES) help protect transmitted data.

2.9.4 ZigBee Applications

ZigBee enables broad-based deployment of wireless networks with low-cost, low-power solutions. It provides the ability to run for years on inexpensive batteries for a host of monitoring applications: Lighting controls, AMR (Automatic Meter Reading), smoke and CO detectors, wireless telemetry, HVAC control, heating control, home security, Environmental controls, drapery and shade controls, etc.

Standard	ZigBee® 802.15.4	Wi-Fi™ 802.11b	Bluetooth™ 802.15.1
Transmission Range (meters)	1 – 100*	1 - 100	1 – 10
Battery Life (days)	100 – 1,000	0.5 – 5.0	1 - 7
Network Size (# of nodes)	> 64,000	32	7
Application	Monitoring & Control	Web, Email, Video	Cable Replacement
Stack Size (KB)	4 – 32	1,000	250
Throughput kb/s)	20 – 250	11,000	720

CHAPTER 3: CIRCUIT DIAGRAM&WORKING



3.1 Working of circuit

As shown in the circuit microcontroller 8951 is the main controlling element. Initially input from mains lines to load is monitored by CT current transformer. This CT gives the current level based on load used by costumer. Output of the CT is current and ac which is rectified and made voltage by signal conditioner circuit consisting of 10 ohm resistor; diode and capacitor. The output of the CT is fed to the ADC0808 for converting analog voltage to digital voltage. ADC0808 does conversion of analog signal into digital by successive approximation method and with the help of clock pulses, which is generated by NOT gate IC, this NOT gate produces 50kHz clock and give it to ADC. The output of the ADC is 8 bit which is fed to the microprocessor for further processing of the data.When power supply is switched ON, so that microcontroller starts program execution from zero memory location.

Microcontroller has four input parts, which are contains 8 lines for input or output. in total we have 32 lines for input and output. In our project 4 lines of microcontroller are used for giving address selection input & ALE signal to ADC for selecting sensor line.

After this microcontroller received 8 bit output from ADC. This output is digital equivalent of power consumption. Microcontroller gets another I/p from maximum limit setting switches, which are connected on pin 10,11,12,13. This gives maximum limit of power which consumer can use during peak time. The peak time pulse are received from real time clock, which is connected on pin no 16&17. This all information is displayed on LCD which is connected on pin 32 to40.

The functions of microcontroller is continuously check power consumption of customer by means of CT, ADC & get digital I/p. this I/p is compare with maximum limit setting. Display both those data on LCD. If the I/p as power consumption exceeds the maximum limit then initially an alarm is sent telling consumer to reduce power consumption. This alarm is given by microcontroller through pin 14, where a transistor amplifies this signal and sounds a buzzer.

After some time delay, microcontroller again check power consumption by customer, if it has decreases then alarm stops or else microcontroller gives another trigger signal on pin 15, which signal is amplified by transistor & fed to relay. This relay cutouts the supply to consumer for predetermined time limit. After this time limit completion againthe supply resumes to consumer & microcontroller check the power consumption again. If consumer exceeds his maximum limit setting again then he gets alarm & cycle is continuous.

CHAPTER 4: DEVELOPMENT STAGES & PROCESS

The complete development of this system can be divided into the following stages:

- Problem definition stage;
- Designing block diagram;
- Implementing circuits and components;
- Developing algorithm for software;
- Writing actual code for Microcontroller;
- Compiling the code;
- Burning the hex file into microcontroller with programmer;
- Testing and Running.

4.1 Problem definition stage

This is the very first stage to develop any project. It actually defines the aim and the concept of the project. The aim of **"Microcontroller Based Data Acquisition and Controlling System with PC interface"** is to design a DAS which can be connected to any type of computer serial port giving the user flexibility of selection of desired number of channels for data acquisition with least complexity and cost.

4.2 Designing block diagram

At this stage we have categorized the whole system into different individual modules. These modules (block diagrams) will be helpful in understanding the concept and working of the integrated system. It also simplifies the entire debugging and testing process.

4.3 Implementing circuits and components

This is the actual implementation of circuit of each block. At this stage we have actually designed each block separately and finally integrated them into the complete working system.

4.4 Developing algorithm for software

To get the logical flow of the software, the development of algorithm is having a prominent role. So that we have analyzed the complete system and organized the algorithm in such a manner that one can understand the complete working of the software.

4.5 Writing actual code for Microcontroller

After the development of the algorithm and flowchart we have actually translated them in C language for Atmel 89C51 Microcontroller so that it can understand the instructions and run as per our requirement. The instructions are in ANSII C Language.

4.6 Compiling the code

The code is implemented on the computer for which we have used Keil pre-installed on PC. The Keil is a Computer Aided Program to simulate the working of Microcontroller in real time without burning the software into actual IC. We simulated and compiled our program for error checking. After removing of several compiling errors the program was converted into machine language i.e. Intel hex format.

4.7 Burning the hex file into microcontroller with Programmer

In this stage the compiled hex format file was downloaded or burned into Atmel AT89C51 flash Microcontroller. This was done with the help of FP-8903 Programmer for Atmel microcontrollers designed by Oriole Electronics Pvt. Ltd.

4.8 Testing and Running

This time we tested our project for actual working, after loading the software into the microcontroller. Any errors found were removed successfully. This is the last and final stage of development of our project.

4.10 P.C.B. Making

- P.C.B. is printed circuit board which is of insulating base with layer of thin copper-foil.
- The circuit diagram is then drawn on the P. C. B. with permanent marker and then it is dipped in the solution of ferric chloride so that unwanted copper is removed from the P.C.B., thus leaving components interconnection on the board.
- The specification of the base material is not important to know in most of the application, but it is important to know something about copper foil which is drawn through a thin slip.
- The resistance of copper foil will have an effect on the circuit operation.
- Base material is made of lamination layer of suitable insulating material such as treated paper, fabric; or glass fibers and binding them with resin. Most commonly used base materials are formed paper bonded with epoxy resin.
- Thickness is the important factor in determining mechanical strength particularly when the commonly used base material is "**Formea**" from paper assembly.
- Physical properties should be self-supporting **these** are surface resistivity, heat dissipation, dielectric, constant, dielectric strength.
- Another important factor is the ability to withstand high temperature.

4.11 Designing the Layout

- While designing a layout, it must be noted that size of the board should be as small as possible.
- Before starting, all components should be placed properly so that an accurate measurement of space can be made.
- The component should not be mounted very close to each other or far away from one another and neither one should ignore the fact that some component reed ventilation, which considerably the dimension of the relay and transformer in view of arrangement, the bolting arrangement is also considered.
- The layout is first drawn on paper then traced on copper plate which is finalized with the pen or permanent marker which is efficient and clean with etching.

- The resistivity also depends on the purity of copper, which is highest for low purity of copper. The high resistance path is always undesired for soldered connections.
- The most difficult part of making an original printed circuit is the conversion from, theoretical circuit diagram into wiring layout, without introducing cross over and undesirable effect.
- Although it is difficult operation, it provides greater amount of satisfaction because it is carried out with more care and skill.
- The board used for project has copper foil thickness in the range of 25 40 75 microns.
- The soldering quality requires 99.99% efficiency.
- It is necessary to design copper path extra-large. There are two main reasons for this,

The copper may be required to carry an extra-large overall current:-

- It acts like a kind of screen or ground plane to minimize the effect of interaction.
- The first function is to connect the components together in their right sequence with minimum need for interlinking i.e. the jumpers with wire connections.
- It must be noted, that when layout is done, on the next day it should be dipped in the solution and board is move continuously right and left after etching perfectly the board is cleaned with water and is drilled.
- After that holes are drilled with 1 mm or 0.8 mm drill. Now the marker on the P. C. B. is removed.
- The Printed Circuit Board is now ready for mounting thecomponents on it.

4.12 Soldering

- For soldering of any joints first the terminal to be soldered are cleaned to remove oxide film or dirt on it. If required flux is applied on the points to be soldered.
- Now the joint to be soldered is heated with the help of soldering iron. Heat applied should be such that when solder wire is touched to joint, it must melt quickly.
- The joint and the soldering iron is held such that molten solder should flow smoothly over the joint.
- When joint is completely covered with molten solder, the soldering iron is removed.
- The joint is allowed to cool, without any movement.
- The bright shining solder indicates good soldering.
- In case of dry solder joint, a air gap remains in between the solder matenal and the joint. It means that soldering is improper. This is removed and again soldering is done.
- This is this way all the components are soldered on P. C. B.

CHAPTER 5: SCOPE OF THE PROJECT

- To help the distributor companies to provide uninterrupted power supplies to consumers.
- To protectDistribution transformer with economical method.

5.1 Advantages

- This is the simplest circuit used for signaling needs only required +12v D.C. supply wireless connection to dialer circuit having limitation.
- This is most economical method of signaling without any complications.
- It has longer life.
- The circuit has high accuracy with great efficiency. And efficiency related with its operation.
- The circuit has more stability.

5. 2 Disadvantages:

- More number of sensorsis required to monitor transformer completely.
- Sensor resolution should be exceeded for precise control.
- Size & price should be reduced as much as possible.

CHAPTER6: CONCLUSIOON

Power transformers play a significant role in power system delivery. Proper application of relay elements that monitor a transformer's thermal state and through-faults can provide both short and long term benefits. These benefits include:

- Transformer overload protection, including cyclic overloads
- Continuous transformer thermal status indication that allows the system operator to make transformer loading decisions based on transformer thermal state
- Cooling system efficiency indication
- Records of cumulative per phase I2t values as seen by the transformer
- Settable I^2t alarm thresholds that can notify the sys- tem operator of excessive through-fault current seen by the transformer
- Cumulative I^2t values as a measure to prioritize trans- former maintenance

Over excitation is a system condition and is not limited to generating stations. Proper application of Volts/Hz elements can prevent damage to transformers resulting from system overvoltage or under frequency conditions.

CHAPTER 7: REFERENCES

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