A

REPORT ON

"PIC BASED LOAD CONTROLLER"

(INFORMATIVE REPORT)

2016-17

SUBMITTED BY:

STUDENTS OF FINAL YEAR **ELECTRICAL**

UNDER THE GUIDANCE OF

Prof. IFTEKAR PATEL

Anjuman-I-Islam's
KALSEKAR TECHNICAL CAMPUS
School of Engineering and Technology
New Panvel

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Submitted to:

Prof. IFTEKAR PATEL

Submitted By:

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PREFACE

We take the opportunity to present this report "**PIC BASED LOAD CONTROLLER".** The object of this report is to control a load using latest technology. The report is supported by circuit diagrams and images to bring out the purpose and message. We have made sincere attempts and taken every care to present this report in precise and compact form, the language being as simple as possible. The task of completion of the project though being difficulty was made quite simple, interesting and successful due to deep involvement and complete dedication of our group members.

CERTIFICATE

This is to certify that this dissertation report entitled **"PIC BASED LOAD CONTROLLER**" is a record of work carried out by

1. SHAIKH AQUIB
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3. SHAIKH REHMAAN
4. MUKADAM SAIF

of B.E. Electrical Engineering is submitted to the Mumbai University in partial fulfillment of the requirement for the degree of Bachelor of Engineering in Electrical Engineering. The project report has been approved.

Prof. IFTEKAR PATEL	Prof.
(Internal Guide)	(External Guide)
Prof. KALEEM SYED	DR.A.R HONNUTAGI
(Head of Department)	(DIRECTOR)

ABSTRACT

Home automation is designed to prevent an actual confrontation between a returning occupant and an intruder. In the market, we found out many systems that can be use to protect the property. However if a member of the family was away, we wanted a system that would inform the member if the house has being broken into. This was ultimate safety that one looks for in a home security system. We can also add features such as lpg gas leakage, fire breakdowns or even water tank overflow.

Chapter 2 deals with the history of home automation along a brief description of Hardware & Software.

Chapter 3 deals with the basics of GSM System. It gives the details of the adopted methodology which includes Block diagram, Circuit diagram, Hardware & Software used.

Chapter 4 deals with Analysis, Experimentation & Results. It includes descriptions of various ICs used, PCB layout & Challenges faced during our project.

Chapter 5 deals with the future scope and conclusion.

In order to make the system ‘smart’, we have made the mobile phone almost a universal remote controller, where in the user can control various devices at his home just through the SMS.

We have even solved the i/o port limitations by expanding the ports using latches and buffers so that more sensors can be interfaced in future.

DECLARATION

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

DATE : **……**

PLACE : **……**

(NAME OF THE STUDENT)

SHAIKH AQUIB **……**

SHUKLA NITIN **……**

SHAIKH REHMAAN **……**

MUKADAM SAIF **……..……..…**

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CHAPTER.1

INTRODUCTION

Nowadays, in modern society this work is very useful if people can operate their domestic electrical appliances when they are away from them. The remote control system allows the user to interact with their appliances without touching them. This type of remote control system is more convenient and installisation process is simple. This new system can operate the wireless mode. The remote system is used to turn on or off the any combination of appliances with a control panel by your beside table, workstation, countertop or anywhere else.The project works on the principle of DTMF tone command, which is received from any phone to remotely switch any electrical load such as agricultural pump, domestic and industrial loads etc. In industries, the loads are spread over a large area and thus, operating these loads is a very tiresome and difficult task. In agricultural fields also, pumps and other loads are connected over a large area and hence it is difficult for the farmer to operate all the loads and similarly for house hold loads. Keeping these problems in mind, the proposed system has been designed which uses DTMF technology to control the loads remotely. A cell phone is interfaced to a DTMF decoder in the system from its audio output socket for receiving tone commands. The receiving cell phone codes are converted into digital commands by a DTMF Decoder which will identify the frequency of the key and convert that frequency to its equivalent digital code which is then fed to the Microcontroller. As per the commands sent from the sender's mobile, the Microcontroller sends signals through a buffer to actuate respective loads by turning the relays ON/OFF. These relays are actuated by a relay driver IC interfaced to the Microcontroller.

CHAPTER.2

LITERATURE SURVEY

Cooperation between smart phone and home appliances becomes important and popular. Especially, smart phones equipped with Bluetooth4.0 can reduce the power consumption, Increase connectable devices, and promote the cooperation between things and smart terminals. The typical devices are BLE, Fuel band and Blue HR (a heartbeat meter developed by Wahoo Fitness).There is a need to use those technologies for controlling home appliances. On the other Hand, in the smart phone application field, many applications for controlling home appliances Have appeared by combining 3G and Wi-Fi technology. But they need a precondition that Available Internet. The main purpose of this research is to develop an appliance control system Without restriction of Internet. Moreover, we will build a dynamic control menu system, which can scan any appliance near a user for controlling at anywhere. The problems can be described more concretely as, how to select devices, how to make communication between devices, and how to save operating data and home appliances information. We adopt Microcontroller as the base of the Middle-Device.

CHAPTER.3

HISTORY OF HOME AUTOTMATION

Home automation technology and Smart home appeared very much in science fiction of the 1920s. But no one knows the exact date of the invention of home automation. Based on human's smart technology improving process, the home automation system does not come by immediate invention. It comes step by step with only insignificant improvement. The previous step is almost same with the next step. (Harper, 2003) The first time people noticed the high technology in dwelling, they did some connection with home automation, it was 1960s. It was called "wired homes" at that time. It was built by some hobbyist. After that, the first official name of home automation appeared in 1984 by the American Association of House Builders. This development is the key to the modern smart homes. (Smith, 1988) People at that time understood that a smart home is not owing to how well it is built, not how effectively it uses space, not due to how it is environmentally friendly. It is only because of how interactive technologies that it contains. Those are still useful rules for home automation technology today. (Smith, 1988) In the 1960s, there were not so much interactive technologies. Even though Stanford University researched a lot of this kind of technology, they didn't become so successful. They concluded some principal reason for not succeeding is scientific research. a) Lacking of motivation to increase productivity in domestic work b) Less involvement of users of the technology in the design process c) The view held by product designers that domestic technology is unexciting d) A continued focus on stand-alone appliances in the design of new technology Early home automation began with labor-saving machines. Self-contained electric or gas Powered home appliances became viable in the 1900s with the introduction of electric power distribution.

Introductionof washingmachines (1904), waterheaters (1889), refrigerators, sewing Machines, dishwashers, and clothes dryers. In 1975, the first general purpose home automation Network technology, X10, was developed. It is a communication protocol for electronic devices? It primarily uses electric power Transmission wiring for signaling and control, where the signals Involve brief radio Frequency bursts of digital data, and remains the most widely available. By 1978, X10 products included a 16 channel command console, a lamp module, and an appliance Module. Soon after came the wall switch module and the first X10 timer. By 2012, in the United States, according to ABI Research, 1.5 million home automation systems were installed.

According to Li et al. (2016) there are three generations of home automation:

1. First generation: wireless technology with proxy server, e.g. Zigbee automation;
2. Second generation: artificial intelligence controls electrical devices, e.g. Amazon echo;
3. Third generation: robot buddy "who" interacts with humans, e.g. Robot Rovio, Roomba.

➢ BENEFITS OF REMOTE CONTROL FOR APPLIANCES

Facilitates wireless control over the equipment.• Maintenance is easy and cost also effective.• Ability to handle multi-channel function.• Tamper proof and easy to portable.• The main objective of this work is to access remote control circuit for industrial appliances. In our project "Industrial Appliances Control Using Microcontroller Processor" we implemented a remote control for industrial appliances in cost effective manner. A control system is a device, or combination of devices to manage, command, direct or regulate the behavior of other device(s) system(s).

Any system can be controlled in two different ways, either manual or automatic. In control systems engineering, a system is actually a group of components. It can capable of performing individual tasks. They are connected in a specific sequence to perform a specific function. A system can be of two types and they are described below:

- Open loop system (Manual control system)
- Closed loop system (automatic control system).

CHAPTER.4

PROJECT BLOCK DIARAM

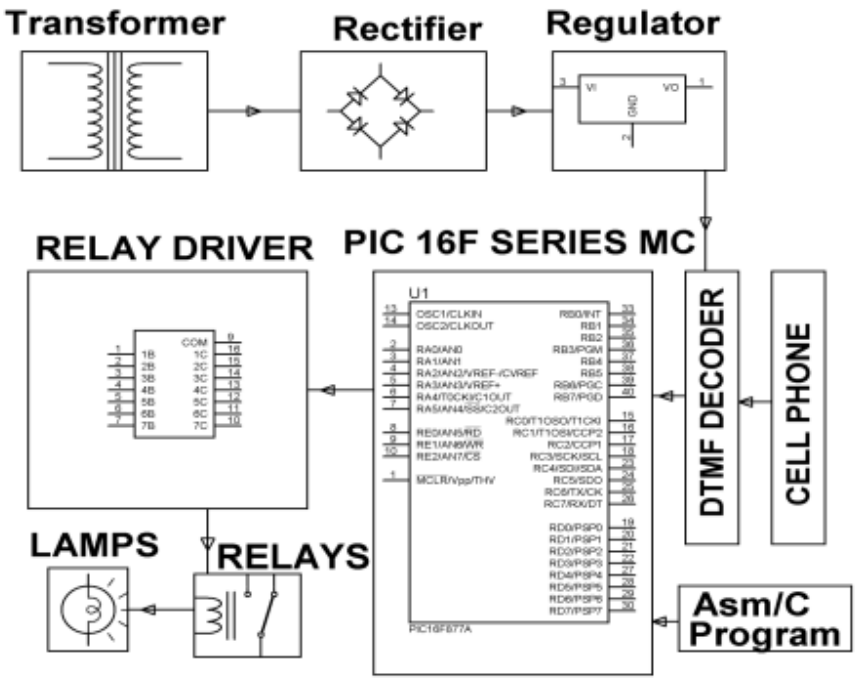


FIG 4.1 PROJECT BLOCK DIAGRAM

- **SOFTWARE REQUIREMENTS:**

Kiel compiler

Languages: Embedded C or Assembly

- **HARDWARE REQUIREMENTS:**

PIC16F8 series Microcontroller, Transformer, DTMF Decoder, Relays, Relay Driver IC, Inverter IC, Voltage Regulator, Crystal, Diodes, Resistors, Capacitors, Lamps.

CHAPTER.5

POWER SUPPLY

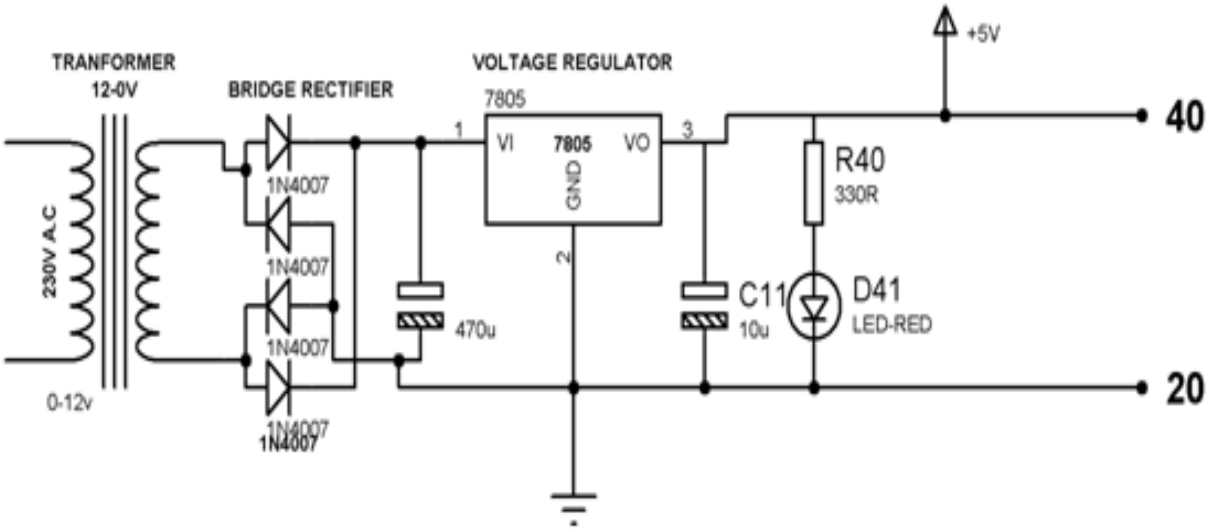


FIG 5.1 POWER SUPPLY

The 230V AC supply is first stepped down to 12V AC using a step down transformer. This is then converted to DC using bridge rectifier.The AC ripples is filtered out by using a capacitor and given to the input pin of voltage regulator 7805. At output pin of this regulator we get a constant 5V DC which is used for MC and other ICs in this project. In this project circuits, sensors & motor are used which require +12V & +5V(DC)supply, to fulfill this requirement we have used following circuit of power supply which provides regulated +12V & +5V.(DC)

➢ WORKING:

As shown above Transformer (15V/1A) is used to down convert the AC upto 15V. 4 diodes (IN4007) are connected to secondary of transformer in bridge for rectifying AC into DC. Capacitor 1000 µf & 1µf are used as a filter red led shows that rectification and filtering is ok.7812 IC is used as a 12V regulator it converts 15V into regulated +12V DC YELLOW led shows that output of 7812 is ok. 7805 IC is used as a 5V regulator it converts 12V into regulated +5V DC green led shows that output of 7805 is ok.

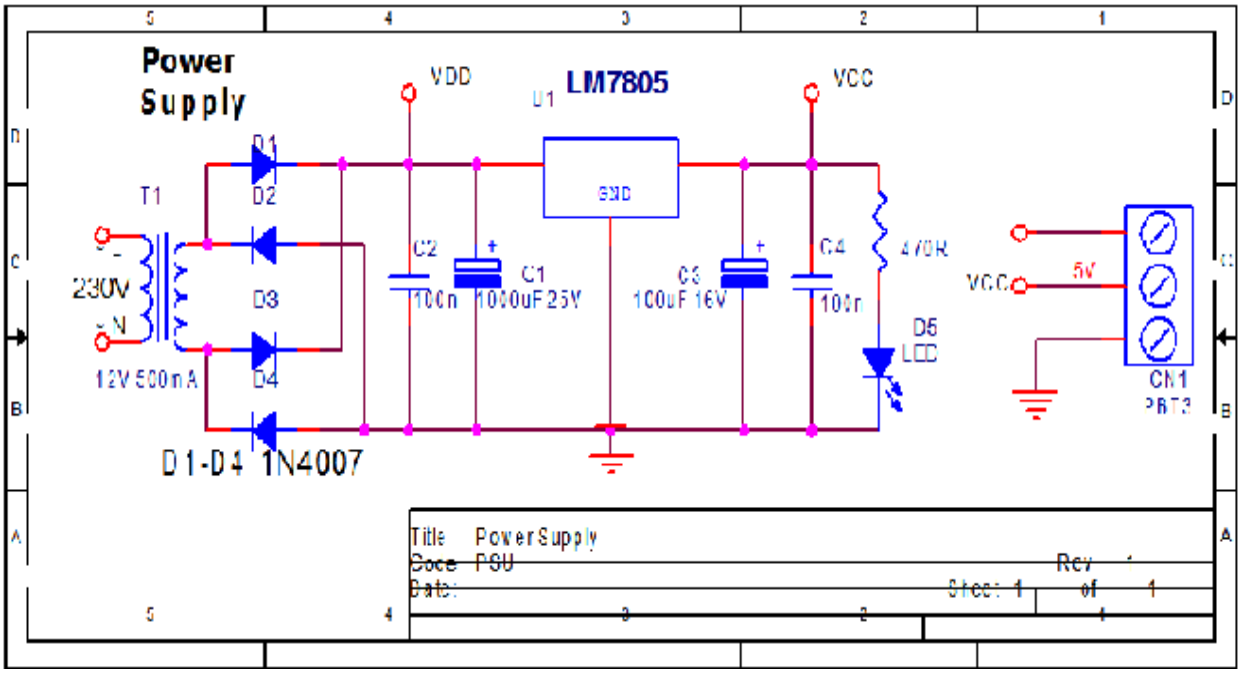


FIG 5.2 POWER SUPPLY CIRCUIT

➢ POWER SUPPLIES

There are many types of power supply. Most are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronics 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:

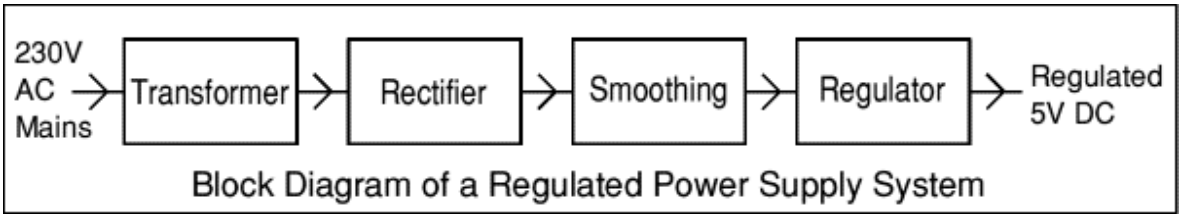


FIG 5.3 BLOCK DIAGRAM OF POWER SUPPLY SYSTEM

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 - smooths the DC from varying greatly to a small ripple.
- Regulator - eliminates ripple by setting DC output to a fixed voltage.

Power supplies made from these blocks are described below with a circuit diagram and a graph of their output:

- Transformer only
- Transformer + Rectifier
- Transformer + Rectifier + Smoothing
- Transformer + Rectifier + Smoothing + Regulator

➢ THE POWER SUPPLY

You will definitely need a regulated 5-volt power supply to work with TTL chips. As mentioned previously, neither Radio Shack nor Jameco seem to offer a standard, inexpensive 5-volt regulated power supply. One option you have is to buy from Jameco something like part number 116089. This is a 5-volt power supply from an old Atari video game. If you look in the Jameco catalog, you will find that they have about 20 different surplus power supplies like this, producing all sorts of voltages and amperages. You need 5 volts at at least 0.3 amps (300 milliamps) -- you need no more than 2 amps, so do not purchase more power supply than you need. What you can do is buy the power supply, then cut off the connector and get access to the 5-volt and ground wires. That will work fine, and is probably the easiest path. You can use your volt meter (see below) to make sure the power supply produces the voltage you need. Your alternative is to build a 5-volt supply from a little power-cube transformer. What you need is a transformer that produces 7 to 12 DC volts at 100 milliamps or more.

Note that:

- The transformer MUST produce DC voltage.
- It MUST produce 7 to 12 volts.
- It MUST produce 100 milliamps (0.1 amps) or more.

➢ DUAL SUPPLIES

Some electronic circuits require a power supply with positive and negative outputs as well as zero volts (0V). This is called a 'dual supply' because it is like two ordinary supplies connected together as shown in the diagram. Dual supplies have three outputs, for example a ±3.3V supply

CHAPTER.6

TRANSFORMER

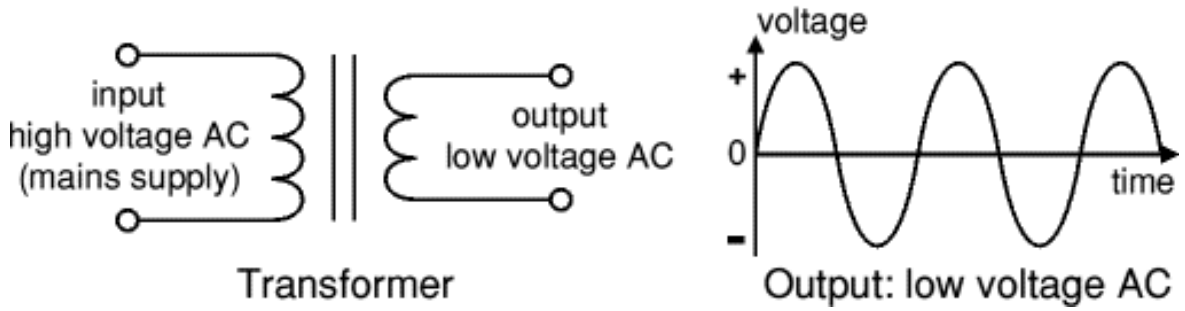


FIG 6.1 TRANSFORMER

The low voltage AC output is suitable for lamps, heaters and special AC motors. It is not suitable for electronic circuits unless they include a rectifier and a smoothing capacitor.

TRANSFORMER + RECTIFIER

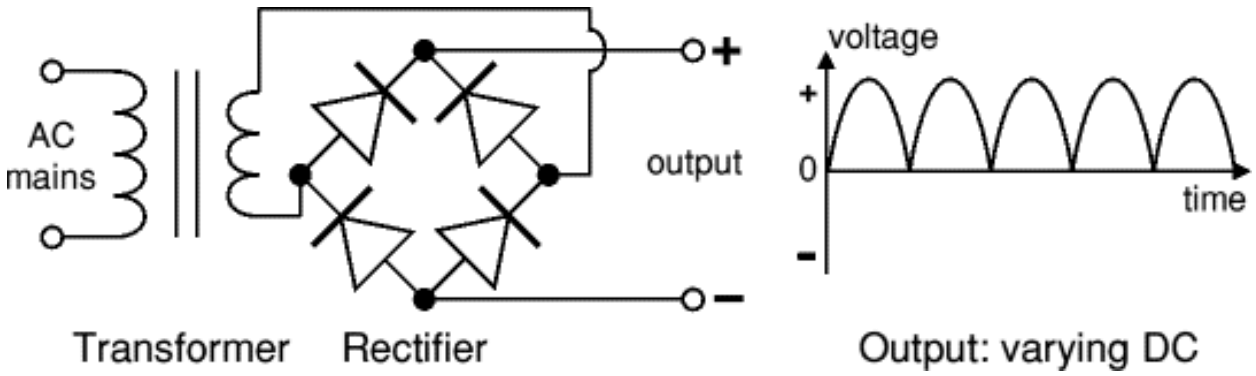


FIG 6.2 TRANSFORMER + RECTIFIER

The varying DC output is suitable for lamps, heaters and standard motors. It is not suitable for electronic circuits unless they include a smoothing capacitor.

TRANSFORMER + RECTIFIER + SMOOTHING

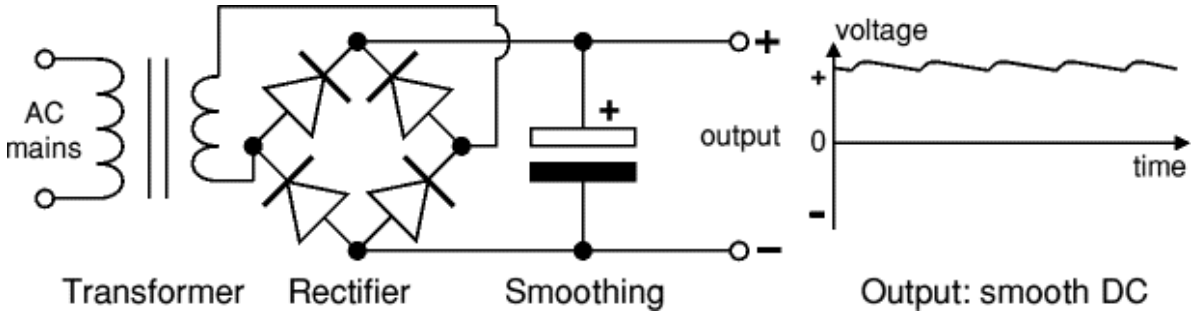


FIG 6.3 TRANSFORMER + RECTIFIER + SMOOTHING

The smooth DC output has a small ripple. It is suitable for most electronic circuits.

TRANSFORMER + RECTIFIER + SMOOTHING + REGULATOR

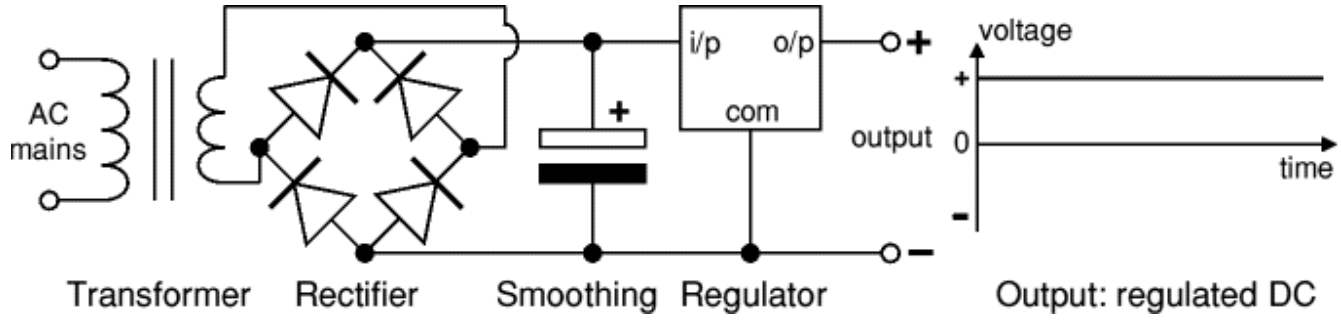
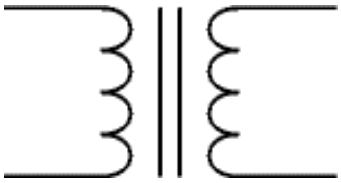


FIG 6.4 TRANSFORMER + RECTIFIER + SMOOTHING + REGULATOR

The regulated DC output is very smooth with no ripple. It is suitable for all electronic circuits.

➢ WORKING OF TRANSFORMER



Transformer circuit symbol

FIG 6.5 TRANSFORMER CIRCUIT

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC. Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in UK) to a safer low voltage. The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils, instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core. Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down current is stepped up. The ratio of the number of turns on each coil, called the turns ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.

$$\textbf{turns ratio} = \frac{\textbf{Vp}}{\textbf{Vs}} = \frac{\textbf{Np}}{\textbf{Ns}} \qquad \textbf{and} \qquad \textbf{power out = power in}$$

$$\textbf{Vs} \times \textbf{Is} = \textbf{Vp} \times \textbf{Ip}$$

Vp = primary (input) voltage Vs = secondary (output) voltage

Np = number of turns on primary coil Ns = number of turns on secondary coil

Ip = primary (input) current Is = secondary (output) current

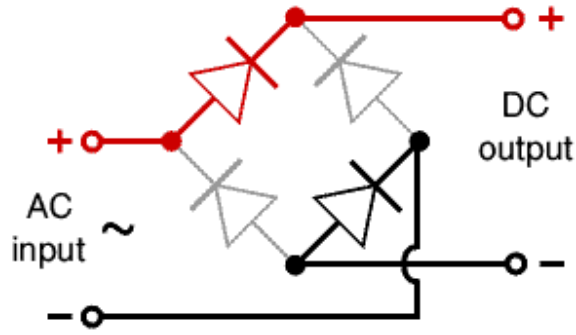
CHAPTER.7

RECTIFIER

There are several ways of connecting diodes to make a rectifier to convert AC to DC. The bridge rectifier is the most important and it produces full-wave varying DC. A full-wave rectifier can also be made from just two diodes if a centre-tap transformer is used, but this method is rarely used now that diodes are cheaper. A single diode can be used as a rectifier but it only uses the positive (+) parts of the AC wave to produce half-wave varying DC.

➢ BRIDGE RECTIFIER

A bridge rectifier can be made using four individual diodes, but it is also available in special packages containing the four diodes required. It is called a full-wave rectifier because it uses all the AC wave (both positive and negative sections). 1.4V is used up in the bridge rectifier because each diode uses 0.7V when conducting and there are always two diodes conducting, as shown in the diagram below. The maximum current they can pass rates bridge rectifiers and the maximum reverse voltage they can withstand (this must be at least three times the supply RMS voltage so the rectifier can withstand the peak voltages). Please see the Diodes page for more details, including pictures of bridge rectifiers.



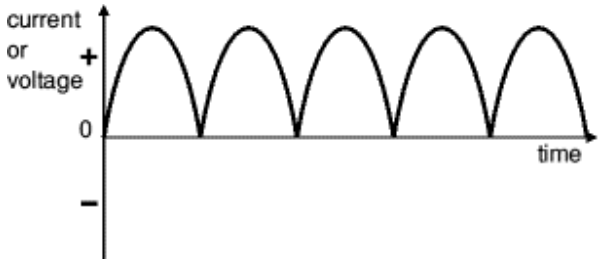


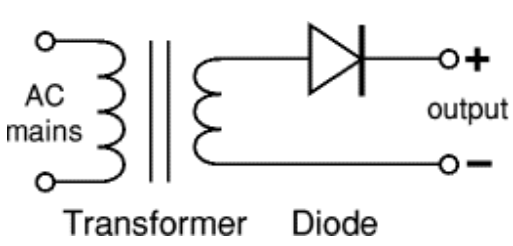
FIG 7.1 BRIDGE RECTIFIER

Output: full-wave varying DC
(using all the AC wave)

Bridge rectifier
Alternate pairs of diodes conduct, changing over
the connections so the alternating directions of AC are converted to the one direction of DC.

➢ SINGLE DIODE RECTIFIER

A single diode can be used as a rectifier but this produces **half-wave** varying DC which has gaps when the AC is negative. It is hard to smooth this sufficiently well to supply electronic circuits unless they require a very small current so the smoothing capacitor does not significantly discharge during the gaps. Please see the Diodes page for some examples of rectifier diodes.



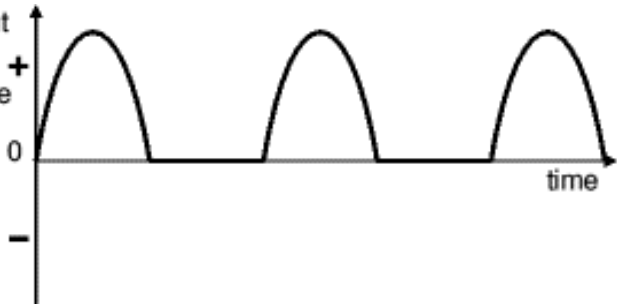


FIG 7.2 SINGLE DIODE RECTIFIER

Output: half-wave varying DC
(using only half the AC wave)

➢ SMOOTHING

Smoothing is performed by a large value electrolytic capacitor connected across the DC supply to act as a reservoir, supplying current to the output when the varying DC voltage from the rectifier is falling. The diagram shows the unsmoothed varying DC (dotted line) and the smoothed DC (solid line). The capacitor charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output.

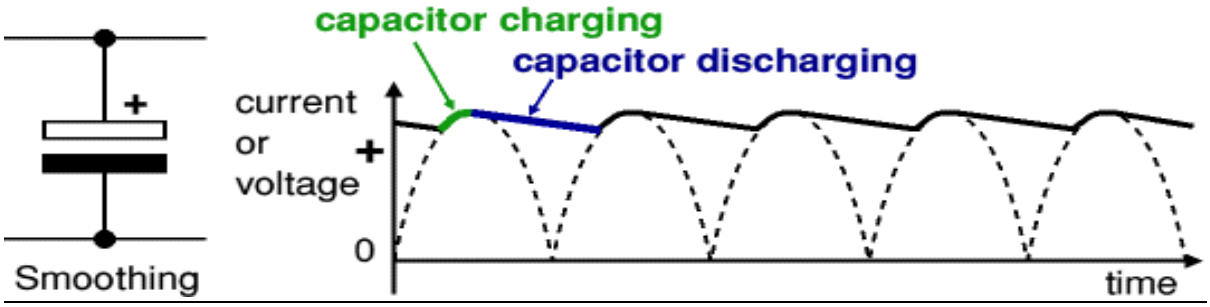


FIG 7.3 CHARGE AND DISCHARGE OF CAPACITOR

Note that smoothing significantly increases the average DC voltage to almost the peak value (1.4 × RMS value). For example 6V RMS AC is rectified to full wave DC of about 4.6V RMS (1.4V is lost in the bridge rectifier), with smoothing this increases to almost the peak value giving 1.4 × 4.6 = 6.4V smooth DC. Smoothing is not perfect due to the capacitor voltage falling a little as it discharges, giving a small ripple voltage. For many circuits a ripple which is 10% of the supply voltage is satisfactory and the equation below gives the required value for the smoothing capacitor. A larger capacitor will give less ripple. The capacitor value must be doubled when smoothing half-wave DC.

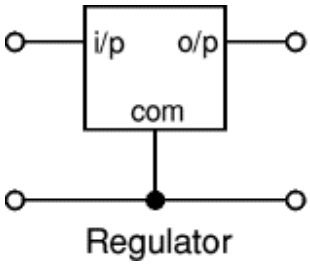
$$\text{Smoothing capacitor for 10\% ripple, } C = \frac{5 \times Io}{Vs \times f}$$

C = smoothing capacitance in farads (F) Io = output current from the supply in amps(A) Vs = supply voltage in volts (V), this is the peak value of the unsmoothed DC f= frequency of the AC supply in hertz (Hz),

CHAPTER.8

REGULATOR

Voltage regulator ICs are available with fixed (typically 5, 12 and 15V) or variable output voltages. They are also rated by the maximum current they can pass. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current ('overload protection') and overheating ('thermal protection').Many of the fixed voltage regulator ICs have 3 leads and look like power transistors, such as the 7805 +5V 1A regulator shown on the right. They include a hole for attaching a heatsink if necessary.



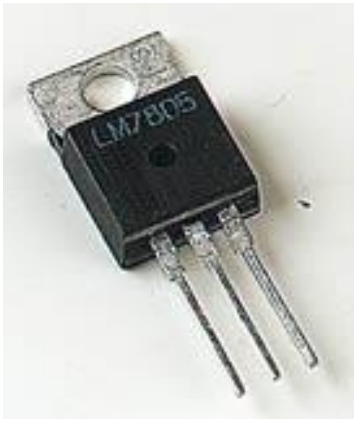


FIG 8.1 RELAY

➢ ZENER DIODE REGULATOR

For low current power supplies a simple voltage regulator can be made with a resistor and a zener diode connected in reverse as shown in the diagram. Zener diodes are rated by their breakdown voltage Vz and maximum power Pz (typically 400mW or 1.3W). The resistor limits the current (like an LED resistor). The current through the resistor is constant, so when there is no output current all the current flows through the zener diode and its power rating Pz must be large enough to withstand this.

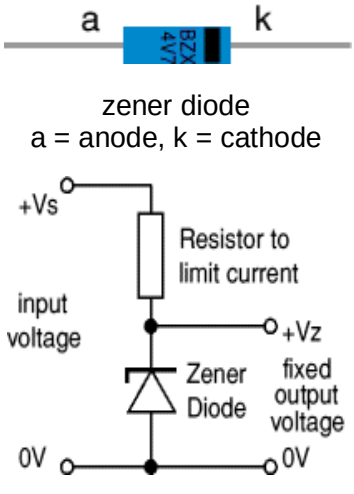


FIG 8.2 ZENER DIODE REGULATOR

➢ Choosing a zener diode and resistor:

1. The zener voltage 3.3V Vz is the output voltage required
2. The input voltage Vs must be a few volts greater than Vz (this is to allow for small fluctuations in Vs due to ripple)
3. The maximum current Imax is the output current required plus 10%
4. The zener power Pz is determined by the maximum current: $Pz > Vz \times Imax$
5. The resistor resistance: $R = (Vs - Vz) / Imax$
6. The resistor power rating: $P > (Vs - Vz) \times Imax$

CHAPTER.9

LCD 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.

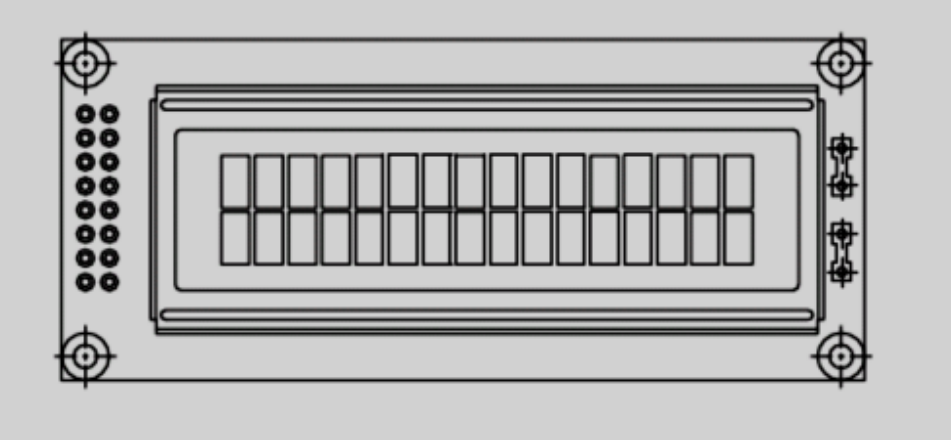


Fig:9.1 LCD Display

- **FEATURES**
  - 16X2 dots with cursor
  - Built-in controller (KS 0066 or Equivalent)
  - + 5V power supply
  - 1/16 duty cycle
  - B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
  - N.V. optional for + 3V power supply
  - RS232 compatible serial interface (2400 & 9600 baud selectable)
  - Externally selectable serial polarities (Inverted & Non-Inverted)
  - Serially controllable contrast and backlight levels
  - 8 user programmable custom characters
  - 16 Byte serial receive buffer

- **PIN DIAGRAM**:

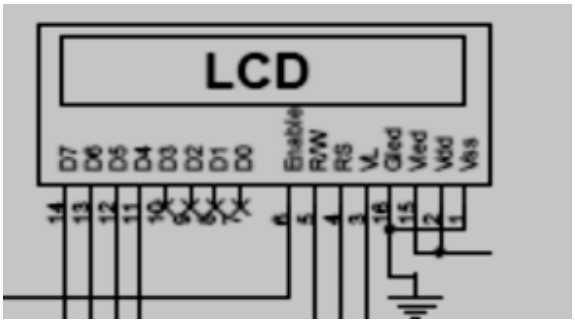


FIG:9.2 LCD PIN DIAGRAM

PIN DIAGRAM DESCRIPTION:

PIN NAME	PIN NO	DESCRIPTION
VSS	1	Gnd
VDD	2	+3V – +5V
V0	3	Contrast adjustment
RS	4	Register select signal
R/W	5	Read write signal
E	6	Enable signal
DB0	7	Data bus line
DB1	8	Data bus line
DB2	9	Data bus line
DB3	10	Data bus line
DB4	11	Data bus line
DB5	12	Data bus line
DB6	13	Data bus line
DB7	14	Data bus line

CHAPTER.10

POWER RELAY

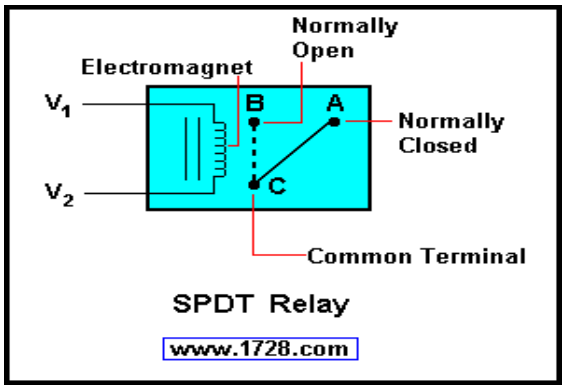
- **Type**: Miniature Power PCB Relay T7N/T7N-WG SPDT TYPE
- **Specification**:12v/7amp

FIG 10.1 POWER RELAY

- **Working :**

Notice in the above diagram that a relay uses an electromagnet. This is a device consisting of a coil of wire wrapped around an iron core. When electricity is applied to the coil of wire it becomes magnetic, hence the term electromagnet. The A B and C terminals are an SPDT switch controlled by the electromagnet. When electricity is applied to V1 and V2, the electromagnet acts upon the SPDT switch so that the B and C terminals are connected. When the electricity is disconnected, then the A and C terminals are connected. It is important to note that the electromagnet is magnetically linked to the switch but the two are NOT linked electrically.

➢ RELAY CONTACTS TYPES :



As well as the standard descriptions of Normally Open, (NO) and Normally Closed, (NC) used to describe how the relays contacts are connected, relay contact arrangements can also be classed by their actions. Electrical relays can be made up of one or more individual switch contacts with each "contact" being referred to as a "pole". Each one of these contacts or poles can be connected or "thrown" together by energizing the relays coil and this gives rise to the description of the contact types as being:

SPST - Single Pole Single Throw

SPDT - Single Pole Double Throw

DPST - Double Pole Single Throw

DPDT - Double Pole Double Throw

with the action of the contacts being described as "Make" (M) or "Break" (B). Then a simple relay with one set of contacts as shown above can have a contact description of:

"Single Pole Double Throw - (Break before Make)", or SPDT - (B-M).

Examples of just some of the more common contact types for relays in circuit or schematic diagrams is given below but there are many more possible configurations.

Relay Contact Configurations

•Where:

• C is the Common terminal

• NO is the Normally Open contact

• NC is the Normally Closed contact

One final point to remember, it is not advisable to connect relay contacts in parallel to handle higher load currents. For example, never attempt to supply a 10A load with two relays in parallel that have 5A contact ratings each as the relay contacts never close or open at exactly the same instant of time, so one relay contact is always overloaded.While relays can be used to allow low power electronic or computer type circuits to switch a relatively high currents or voltages both "ON" or "OFF".

Never mix different load voltages through adjacent contacts within the same relay such as for example, high voltage AC (240v) and low voltage DC (12v), always use sperate relays for safety.One of the more important parts of any relay is the coil. This converts electrical current into an electromagnetic flux which is used to operate the relays contacts. The main problem with relay coils is that they are "highly inductive loads" as they are made from coils of wire. Any coil of wire has an impedance value made up of resistance (R) and inductance (L) in series (RL Series Circuit).As the current flows through the coil a self induced magnetic field is generated around it. When the current in the coil is turned "OFF", a large back emf (electromotive force) voltage is produced as the magnetic flux collapses within the coil (transformer theory). This induced reverse voltage value may be very high in comparison to the switching voltage, and may damage any semiconductor device such as a transistor, FET or microcontroller used to operate the relay coil.

➢ WORKING OF RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

FIG 10.2 DIFFERENT RELAYS

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have double throw (changeover) switch contacts as shown in the diagram.

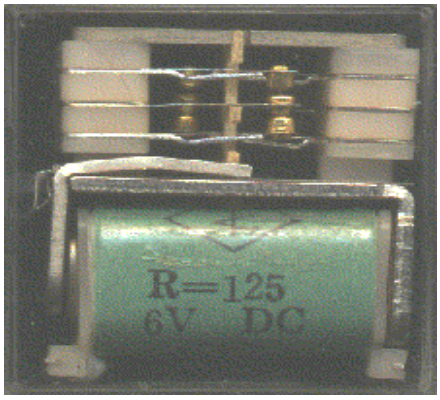


FIG 10.3 RELAY SHOWING COIL AND SWITCH CONTROL

Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a

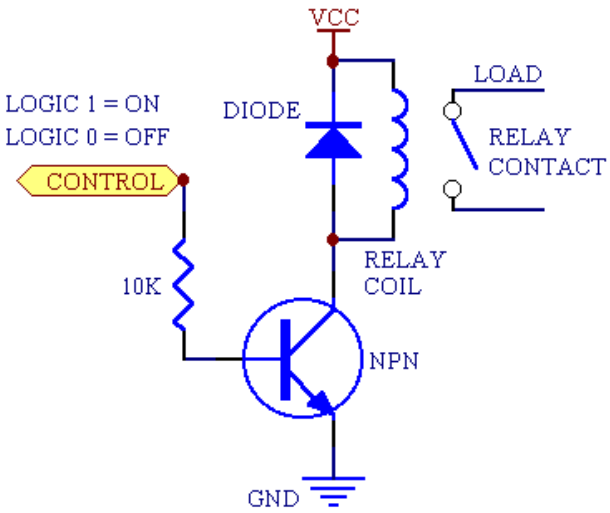
230V AC mains circuit. There is no electrical connection inside the relay between the two circuits; the link is magnetic and mechanical.
The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. For further information about switch contacts and the terms used to describe them please see the page on switches.

Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay.

The supplier's catalogue should show you the relay's connections. The coil will be obvious and it may be connected either way round. Relay coils produce brief high voltage 'spikes' when they are switched off and this can destroy transistors and ICs in the circuit. To prevent damage you must connect a protection diode across the relay coil.

The figure shows a relay with its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on. This lever moves the switch contacts.



There is one set of contacts (SPDT) in the foreground and another behind them, making the relay DPDT.

The relay's switch connections are usually labelled COM, NC and NO:

- COM = Common, always connect to this; it is the moving part of the switch.
- NC = Normally Closed, COM is connected to this when the relay coil is off.
- NO = Normally Open, COM is connected to this when the relay coil is on.

➢ APPLICATION OF RELAY

Relays are used to and for:

- Control a high-voltage circuit with a low-voltage signal, as in some types of modems or audio amplifiers.
- Control a high-current circuit with a low-current signal, as in the starter solenoid of an automobile.

- Detect and isolate faults on transmission and distribution lines by opening and closing circuit breakers.
- Time delay functions. Relays can be modified to delay opening or delay closing a set of contacts. A very short (a fraction of a second) delay would use a copper disk between the armature and moving blade assembly. Current flowing in the disk maintains magnetic field for a short time, lengthening release time. For a slightly longer (up to a minute) delay, a dashpot is used. A dashpot is a piston filled with fluid that is allowed to escape slowly. The time period can be varied by increasing or decreasing the flow rate. For longer time periods, a mechanical clockwork timer is installed.

CHAPTER.11

MICROCONTROLLER

- **PIC 16F877:**

  PIC16F877 is one of the most commonly used microcontroller especially in automotive, industrial, appliances and consumer applications.

- **High-Performance RISC CPU:**

  • Only 35 single-word instructions to learn

  • All single-cycle instructions except for program branches, which are two-cycle

  • Operating speed: DC – 20 MHz clock input DC – 200 ns instruction cycle

  • Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes of Data Memory (RAM), Up to 256 x 8 bytes of EEPROM Data Memory.

  • Pinout compatible to other 28-pin or 40/44-pin PIC16CXXX and PIC16FXXX microcontrollers.

- **Peripheral Features:**

  • Timer0: 8-bit timer/counter with 8-bit prescaler.

  • Timer1: 16-bit timer/counter with prescaler, can be incremented during Sleep via external crystal/clock.

  • Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler.

• Two Capture, Compare, PWM modules - Capture is 16-bit, max. resolution is 12.5 ns.- Compare is 16-bit, max. resolution is 200 ns - PWM max. resolution is 10-bit

• Synchronous Serial Port (SSP) with SP (Master mode) and I2C™ (Master/Slave)

• Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with 9-bit address0 Detection

• Parallel Slave Port (PSP) – 8 bits wide with external RD, WR and CS controls (40/44-pin only)

• Brown-out detection circuitry for Brown-out Reset (BOR).

- **Analog Features:**

• 10-bit, up to 8-channel Analog-to-Digital Converter (A/D)

• Brown-out Reset (BOR)

• Analog Comparator module with:

- Two analog comparators

- Programmable on-chip voltage reference (VREF) module

- Programmable input multiplexing from device inputs and internal voltage reference

- Comparator outputs are externally accessible

Device	Program FLASH	Data Memory	Data EEPROM
PIC16F874	4K	192 Bytes	128 Bytes
PIC16F877	8K	368 Bytes	256 Bytes

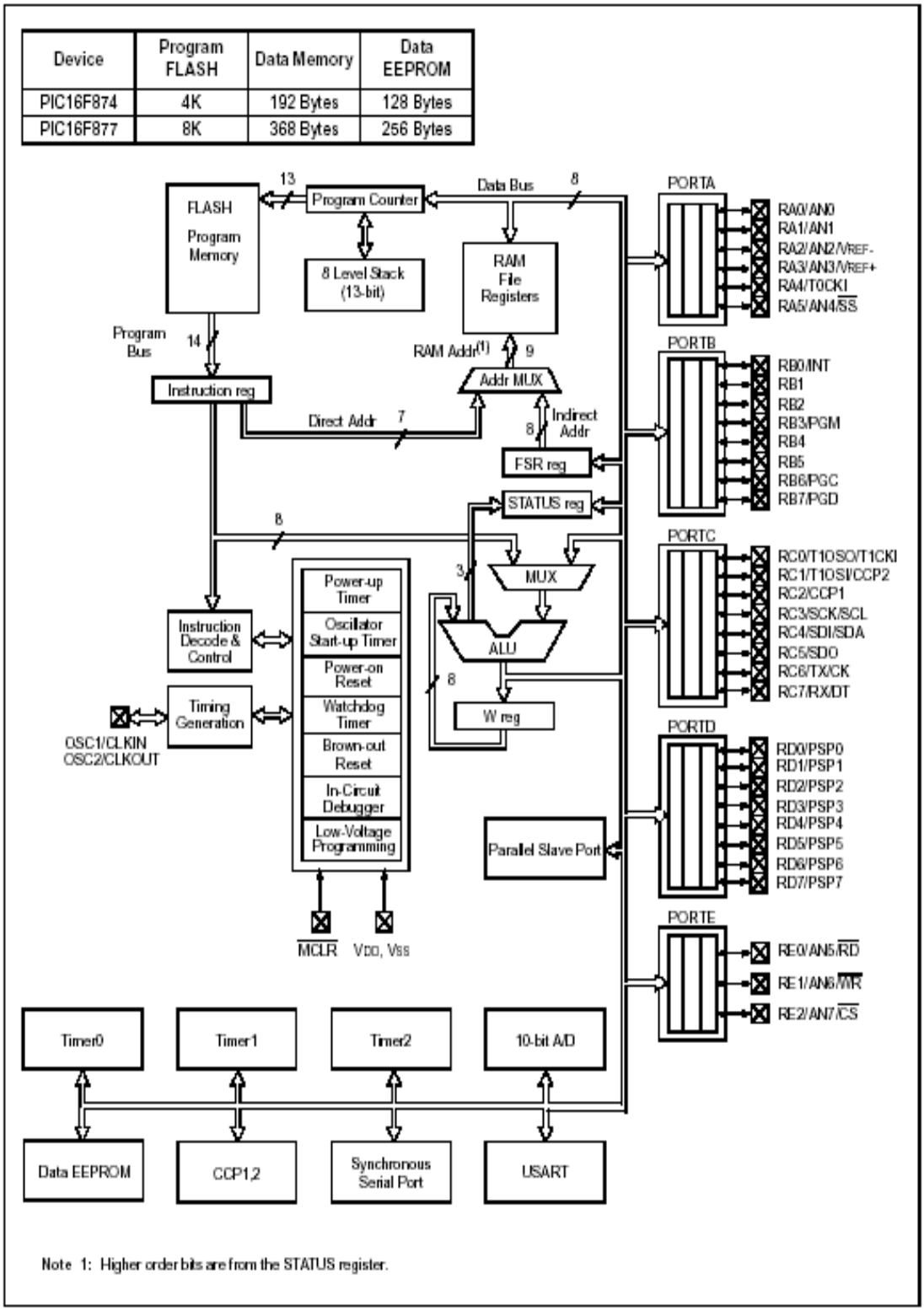


Fig 11.1 MICROCONTOLLER PIN DIAGRAM

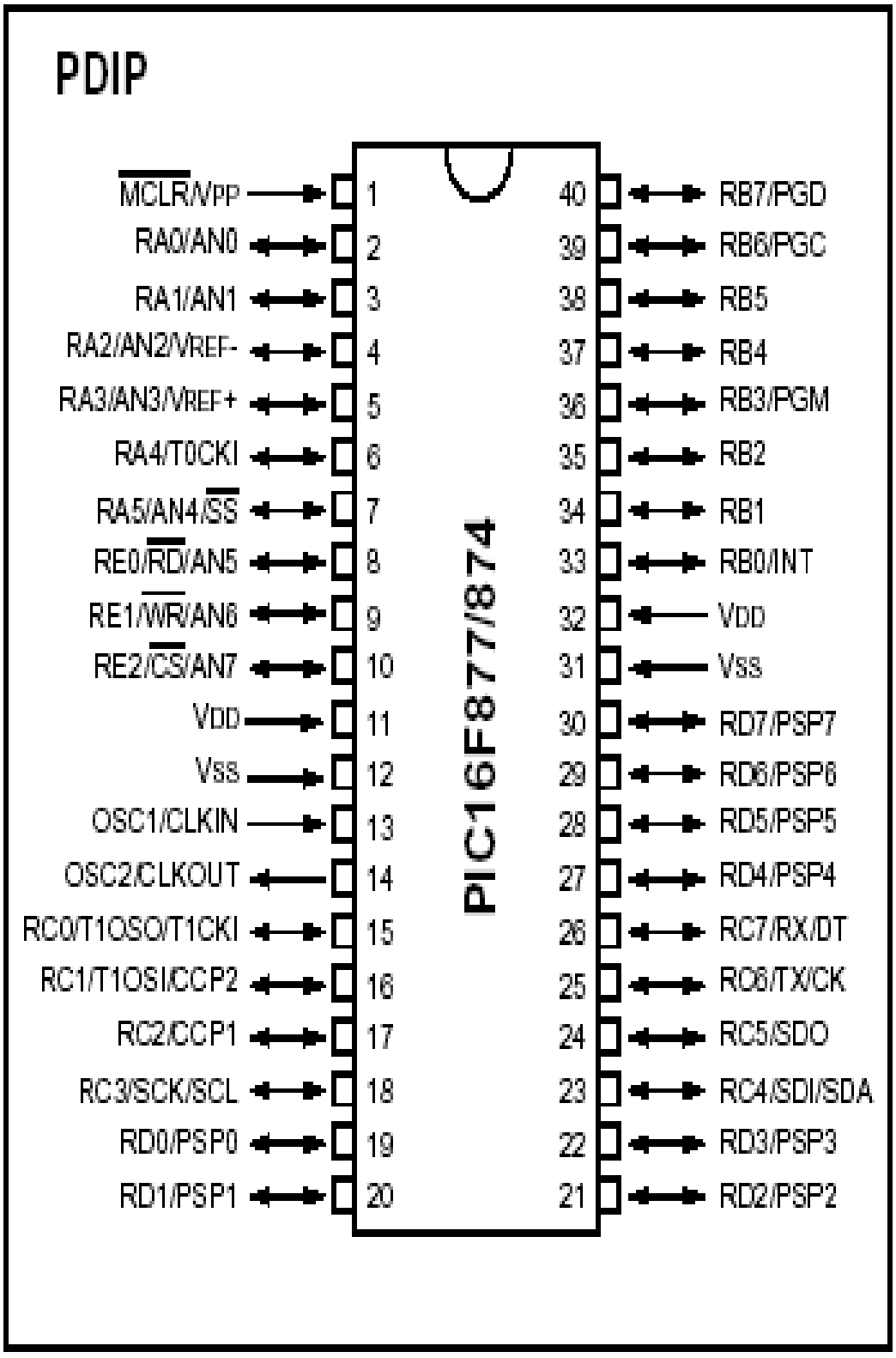


Fig 11.2 PIC PIN DIAGRAM

CHAPTER.12

GSM RESPIRATION

➢ GSM MODEM:-

Mobile voice and data services are transmitting through GSM. GSM operates in Quad Band 850/900/1900MHz. Supply Voltage for GSM is 3.4V to 4.5Volt. GSM is a low power consumption module. Operating temperature of GSM is -30C to 80C.

FIG 12.1 GSM MODEM

Table: COMPARISON OF BLUETOOTH, WI-FI, ZIGBEE AND GSM

STANDARD	BLUETOOTH	WI-FI	ZIGBEE	GSM
IEEE specifications	802.15.1	802.1.1a/b/g	802.15.4	802.11
Frequency band	2.4GHZ	2.4GHZ; 5GHZ	868/915MHZ; 2.4GHZ	850/900/1900MHZ
Max signal rate	1Mb/s	54Mb/s	250Kb/s	Up to 9.6Kb/s
Nominal range	10 m	100 m	10-100 m	More than Others
Power consumption	Medium	High	Low	Low
Typical applications	Wireless connectivity between devices such as phones, PDA, laptops, handsets.	Internet access, PC to PC communication, Stream video, gaming, shared printing.	Industrial control and monitoring, sensor networks, building automation, home automation and control, toys, games.	Digital Communication such GPS,. phones, Laptops

- **MODEM SPECIFICATION:**

This GSM modem is a highly flexible plug and play GSM 900 operating frequency modem for direct and easy integration RS232, voltage range for the power supply and audio interface make this device perfect solution for system integrators and single user. Voice, Data/Fax, SMS, GPRS, integrated TCP/IP stack, RTC and other features like the GSM / GPRS. It has Built-in TCP/IP Protocol Built-in RTC in the module. AT Command based system it has the signaling speed of 85.6 kbps.

- **POWER SUPPLY:**

i.Input voltage: 9V-12V

ii. Input current: 15mA in idle mode, 110mA in communication

iii. Temperature range: Operating -20 to +55 degree Celsius; Storage

iv. Output DC Voltage: 12V

v. Output DC Current : 2A

Interfaces user can connect the GSM modem and initializes the modes like speed and incoming and outgoing by connecting to the following connectors

RS-232 through D-TYPE 9 pin connector

ii. Serial port baud rate 1200 to 115200 bps.

➢ GSM RESPIRATION

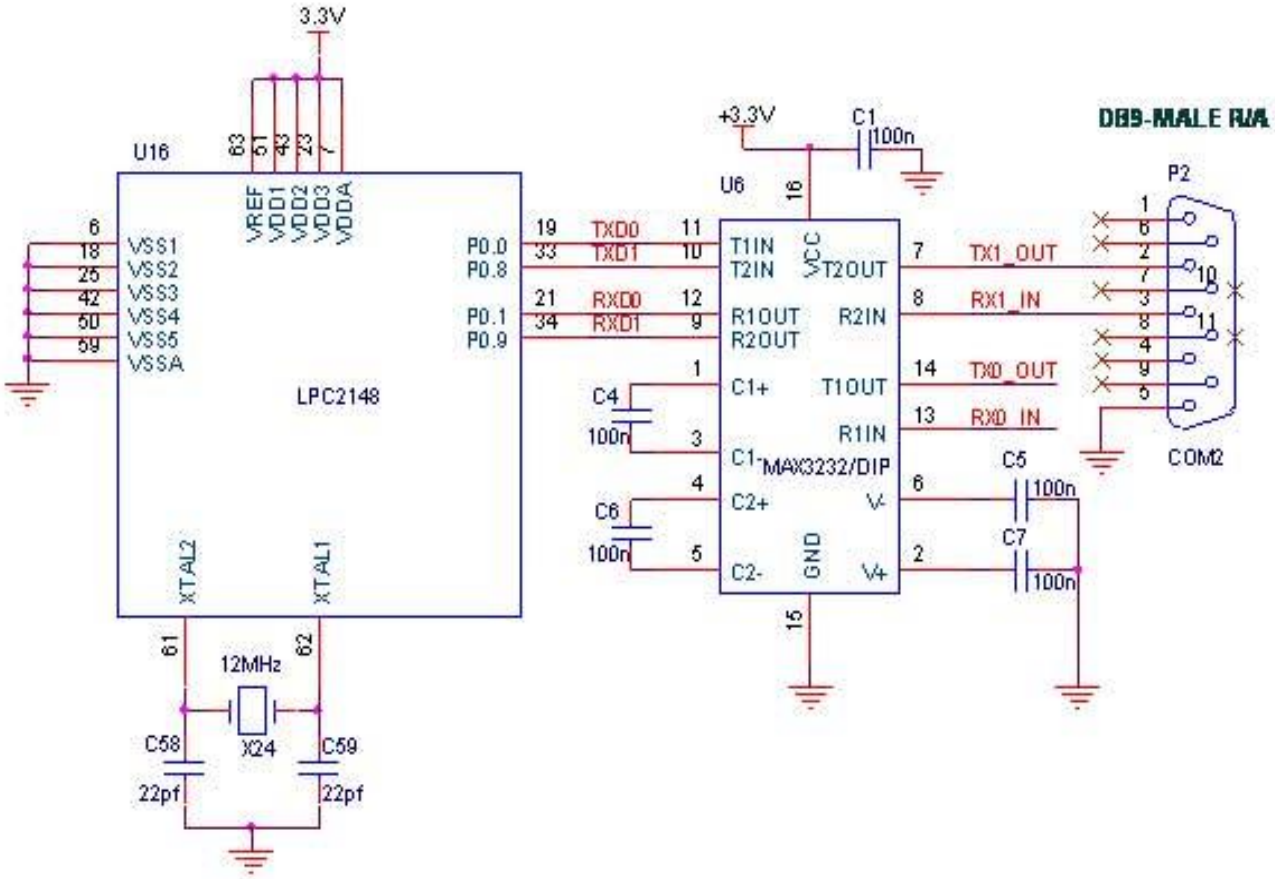


FIG 12.2 GSM RESPIRATION

➢ User Guide for GSM-P1 Modem

1.This box includes the Modem and the RF Antenna.

2.Connect the power Supply (9-12V, 2A) to the power jack. Polarity should be Center +ve and outer –ve. DC jack is provided for power supply connection.

3.DB9 female connector is provided. Use service cable (one to one) for RS-232 communication with HyperTerminal (PC). Please note: for 3 wire communication short pin 7 & 8 at modem and connector.

4.Press the yellow pin to remove the tray from the Sim cardholder. After properly fixing the sim card in the tray, insert the tray in the slot provided.

5.Screw the RF antenna on the RF cable output provided. Keep the antenna where there is maximum signal gain.

6. Network Led is provided for indicating various status of GSM module eg. Power on, network registration & GPRS connectivity.

7.After the Modem registers the network, green led will blink in step of 3 secs. At this stage you can start using our Modem for you application.

8.Default baud rate is 9600 with 8-N-1

9.To change the baud rate use, AT+IPR command. For details please refer AT command

- **GSM USER MANUAL**

GSM/GPRS RS232 Modem from rhydoLABZ is built with SIMCOM Make SIM900 Quad-band GSM/GPRS engine, works on frequencies 850 MHz, 900 MHz, 1800 MHz and 1900 MHz. It is very compact in size and easy to use as plug in GSM Modem. The Modem is designed with RS232 Level converter circuitry, which allows you to directly interface PC Serial port .The baud rate can be configurable from 9600-115200 through AT command. Initially Modem is in Autobaud mode. This GSM/GPRS RS232 Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS as well as DATA transfer application in M2M interface. The modem needed only 3 wires (Tx,Rx,GND) except Power supply to interface with microcontroller/Host PC. The built in Low Dropout Linear voltage regulator allows you to connect wide range of unregulated power supply (4.2V -13V). Yes, 5 V is in between !! .Using this modem, you will be able to send & Read SMS, connect to internet via GPRS through simple AT commands.

➢ Examples for SMS Voice Calls.

For sending SMS in text Mode:

AT+CMGF=1 press enter

AT+CMGS=”mobile number” press enter

Once The AT commands is given’ >’ prompt will be displayed on the screen.

Type the message to sent via SMS. After this, press ctrl+Z to send the SMS.

If the SMS sending is successful, “ok” will be displayed along with the message number.

For reading SMS in the text mode:

AT+CMGF=1 Press enter

AT+CMGR= no.

Number (no.) is the message index number stored in the sim card. For new SMS, URC will be received on the screen as +CMTI: SM ‘no’. Use this number in the AT+CMGR number to read the message.

COMMANDS:

Command	Description
AT+CMGD	DELETE SMS MESSAGE
AT+CMGF	SELECT SMS MESSAGE FORMAT
AT+CMGL	LIST SMS MESSAGES FROM PREFERRED STORE
AT+CMGR	READ SMS MESSAGE
AT+CMGS	SEND SMS MESSAGEF
AT+CMGW	WRITE SMS MESSAGE TO MEMORY
AT+CMSS	SEND SMS MESSAGE FROM STORAGE
AT+CMGC	SEND SMS COMMAND
AT+CNMI	NEW SMS MESSAGE INDICATIONS
AT+CPMS	PREFERRED SMS MESSAGE STORAGE
AT+CRES	RESTORE SMS SETTINGS
AT+CSAS	SAVE SMS SETTINGS
AT+CSCA	SMS SERVICE CENTER ADDRESS
AT+CSCB	SELECT CELL BROADCAST SMS MESSAGES
AT+CSDH	SHOW SMS TEXT MODE PARAMETERS
AT+CSMP	SET SMS TEXT MODE PARAMETERS
AT+CSMS	SELECT MESSAGE SERVICE

FLOWCHART:

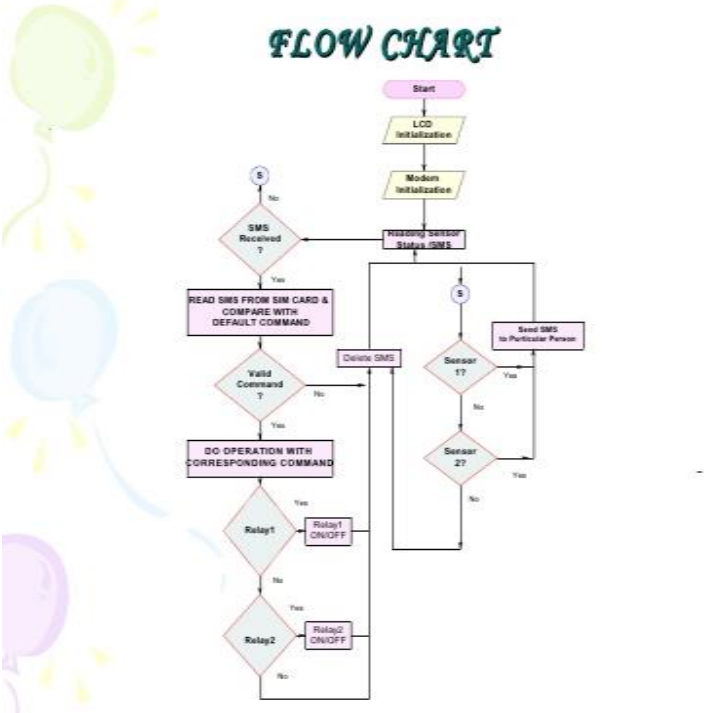


FIG 12.3 FLOWCHART OF PROGRAM

CHAPTER.13

FABRICATION OF PCB

➢ 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 affect on the circuit operation.
- Base material is made of lamination layer of suitable insulating material such as treated report, fabric; or glass fibers and binding them with resin. Most commonly used base materials are formed report bonded with epoxy resin.
- It is possible to obtain a range of thickness between 0.5 mm to 3 mm.
- 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 wishstand high temperature.

➢ 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 considerely 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 are always undesired for soldered connections.
- The most difficult part of making an original printed circuit is the conversion from, theretical circuit diagram into wiring layout. without introducing cross over and undesirable effect.
- Although it is difficult operation, it provides greatent 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 intraction.
- 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 the components on it.

➢ 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.
- Thus is this way all the components are soldered on P. C. B.

➢ Advantages:

- It is easy to design and manufacture as all the components are easily available.
- It is highly accurate and precise and also very reliable.
- . It is portable and hence can be placed anywhere.
- The use of a micro-controller increases its scope of applications and modifications.
- It has low cost of manufacturing
- .The μC can be reprogrammed if any modification is required.
- Due to wireless communication data rate is faster
- Wireless makes ease of operation
- no need of lengthy wires
- power consumption is less

➢ Disadvantages:

- If power supply fails system won't work
- Failure of device/components may have dire consequences, fatal accidents can occur.

CONCLUSION

In this report design and the implementation of an Industrial appliances control using Microcontroller processor. The system has a user friendly interface and employs some techniques to reduce the power consumption. Communication of the system is complete wireless, which makes the system easy to install and use. The feature of this system is to adapt the appliances changes in different room. such as office, homes & hotels. In addition, the wireless transceiver modules enable the system to transfer other information such as voice rather than just alarm signals. As a result, the system can slightly be expanded to other applications. It provides accurate results and also have noise reduction ability. Since it consists of feed back loop, it may create oscillatory response of the system and it also reduces the overall gain of the system. Since Mobile phones have become an indispensable part of our life. Our system uses a controller and a cellular phone for its operations. The systems can be used as a test bed for any application that requires on-off switching based applications. Wireless controlled home appliances in the comforts of any environment will revolutionize our way of living. Controlling appliances remotely by a cell phone will one day become a reality and one should give thanks to the capabilities of HACS. HACS might one day become a standard system in the new homes to come.

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