NEAR EAST UNIVERSITY

Faulty of Engineering

Department of Electrical and Electronic Engineering

PIC PROGRAMMING FOR CONTROL THREE PHASE MOTORS

Graduation Project
EE-400

Student : Halis Hakan Ayan(20010893)

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Nicosia-2006

ACKNOWLEDGMENTS

First I want to thanks Asst.Prof.Özgür Özerdem to my advisor.Under his guidance,I successfully overcome many difficulties and learn a lot about PIC (Peripheral Interface Controller) and motors.In each discussion,he explained my questions patiently,and I felt my quick progress from his advises.He always helps me alot either in my study or my life.I asked him many questions in electronics and motors and he always answered my questions quickly and in detail.

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ABSTRACT

In the Project the control of motors by pic was realized.This means that high voltage is controlled with low voltage.THe cost is very low with pic.If possible LCD screen and IR could be used for developing the system.

Everyhing is starting to high to led and low to led with pic programming.But the most important is activate the ports at the same time with the pic.This event was created from the seven segment display logic.After that a table for ports was created and to see how to continue to start and to finish the program.

One of the most important part is using the relays.The left side part is control part and right side is used to operate three phase motors.Wall panel is used to connect the motors to pic.This wall panel has contactor to trigger the motors.The neutral in the wall is used to control the motor by pic.

Many more beneficial things can be done by using pic programming in the industry.Pic have developing logic by engineer so easy to find good and beneficial things.

INTRODUCTION

Never before has it been so quick and easy to create microprocessor-based circuits. With the advent of the new PIC range of 8-bit microcontrollers and the high performance, low cost software available, a project can take literally a morning to progress from initial conception to final prototype.

Developing a PIC-based project takes only six easy steps:

1. Type in the program
2. Assemble the program into a binary file(but we use Pic Basicpro codes)
3. Simulate the program and debug it(in this section we use MicroCode Studio program we did not want to simulate it.we find the hex decimal doc. with use these program)
4. Load the binary program into the PIC's memory(in this section we use Ic-Prog program)
5. Wire up the circuit
6. Switch on and test.

It's as easy as that!

In the early 1980s, the term PIC stood for Peripheral Interface Controller. These devices were originally designed for use in applications with 16-bit microprocessors and computer peripherals,remote control transmitters, domestic products and automotive systems.

While the PIC data sheets are both comprehensive and informative, it is quite difficult and time consuming for the beginner to wade through the documentation to find out where and how to start. After reading this project and building the easy projects described, progressing to more advanced systems with other PIC microcontrollers is quite straightforward.

A microcontroller (or microprocessor) can be viewed as a set of digital logic circuits integrated on a single silicon 'chip' whose connections and behaviour can be specified and later altered when required, by the program in its memory. The great advantage of this, is that in order to change the circuit's *structure* and *operation*, all that is needed is a change in the program - very little, if any, circuit hardware modifications are necessary. An alternative view is that a microcontroller is a *state machine* whose logic states are defined by its program. A *microprocessor* is the Central Processing Unit (CPU) of a computer and a microcontroller can be regarded as a microprocessor designed specifically for use in applications where machines such as automobile engines or washing machines are to be controlled. Often the distinction between microprocessors and microcontrollers is quite blurred, as there is considerable overlap these days in the classification of different types of computing devices. A typical microprocessor is a device used in workstation computers, whereas microcontroller is usually

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TABLE OF CONTENTS

1.MICROCONTROLLERS

It is a microcomputer used for precise process control, in data handling, communication, and manufacturing..It is first programmed and later used for any application.

Some important features of Pic16F84 will be discussed in this section. Since the Pic 16F84A itself may not be explained completely in hudreds of pages, there will not be much details in this project about it. This section simply indroduce the Pic16F84A, its registers.This section also introduces how to programe the Pic16F84.

1.1. The Pic16F84A

The PIC16F84A belongs to the mid-range family of the PICmicro® microcontroller devices. The program memory contains 1K words, which translates to 1024 instructions, since each 14-bit program memory word is the same width as each devce instruction. The data memory (RAM) contains 68 bytes. Data EEPROM is 64 bytes. There are also 13 I/O pins (Port A - Port B)that are user-configured on a pin-to-pin basis. Some pins are multiplexed with other device functions. These functions include:

- External interrupt
- Change on PORTB interrupt
- Timer0 clock input

The Mid-Range Architecture includes members of the PIC12 and PIC16 families that feature a 14-bit program word architecture. These families are available with 8- to 64-pin package options. The PIC microcontrollers featuring Microchip's Mid-Range 14-bit program word architecture are available in higher pin-count packages with Flash and OTP program memory options. The Flash products offer an operating voltage range of 2.0V to 5.5V, small package footprints, interrupt handling, a deeper hardware stack, multiple A/D channels and EEPROM data memory. All of these features provide the Mid-Range microcontrollers with an intelligence level not previously available. See the block diagram in Figure 1.25 to see features of Pic16f84A. See Table 1.1 for pin descriptions.

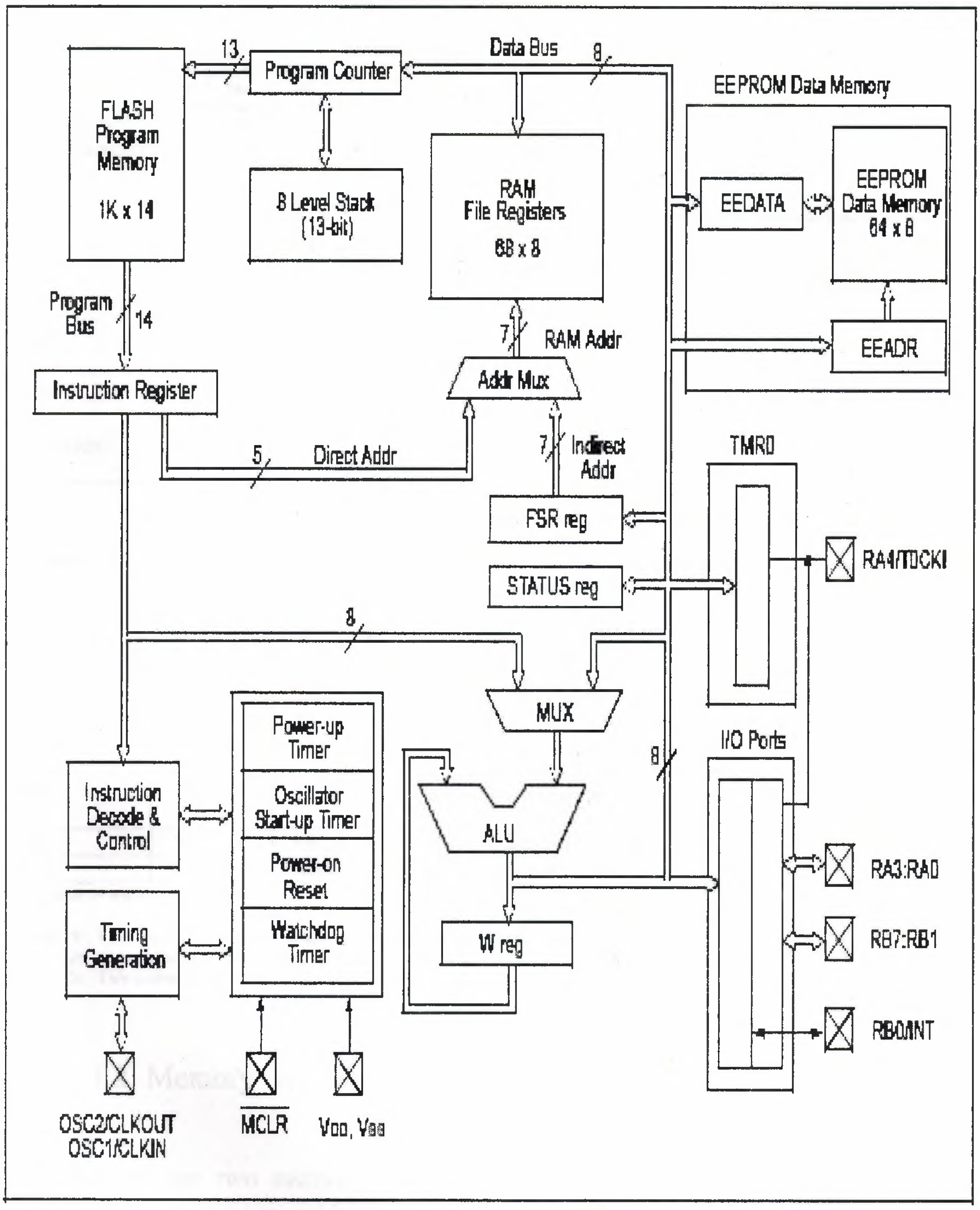


Figure 1.1. Features of PIC16F84A

Table 1.1 Pin Descriptions of PIC16F84A

Pin Name	PDIP No.	SOIC No.	SSOP No.	I/O/P Type	Buffer Type	Description
OSC1/CLKIN	16	16	18	I	ST/CMOS[3]	Oscillator crystal input/external clock source input.
OSC2/CLKOUT	15	15	19	O	—	Oscillator crystal output. Connects to crystal or resonator in Crystal Oscillator mode. In RC mode, OSC2 pin outputs CLKOUT, which has 1/4 the frequency of OSC1 and denotes the instruction cycle rate.
$\overline{\text{MCLR}}$	4	4	4	I/P	ST	Master Clear (Reset) input/programming voltage input. This pin is an active low RESET to the device.
						PORTA is a bi-directional I/O port.
RA0	17	17	19	I/O	TTL	
RA1	18	18	20	I/O	TTL	
RA2	1	1	1	I/O	TTL	
RA3	2	2	2	I/O	TTL	
RA4/T0CKI	3	3	3	I/O	ST	Can also be selected to be the clock input to the TMR0 timer/counter. Output is open drain type.
						PORTB is a bi-directional I/O port. PORTB can be software programmed for internal weak pull-up on all inputs.
RB0/INT	6	6	7	I/O	TTL/ST[1]	RB0/INT can also be selected as an external interrupt pin.
RB1	7	7	8	I/O	TTL	
RB2	8	8	9	I/O	TTL	
RB3	9	9	10	I/O	TTL	
RB4	10	10	11	I/O	TTL	Interrupt-on-change pin.
RB5	11	11	12	I/O	TTL	Interrupt-on-change pin.
RB6	12	12	13	I/O	TTL/ST[2]	Interrupt-on-change pin. Serial programming clock.
RB7	13	13	14	I/O	TTL/ST[2]	Interrupt-on-change pin. Serial programming data.
VSS	5	5	5,6	P	—	Ground reference for logic and I/O pins.
VDD	14	14	15,16	P	—	Positive supply for logic and I/O pins.

Legend: I= input O = Output I/O = Input/Output P = Power
— = Not used TTL = TTL input ST = Schmitt Trigger input

Note 1: This buffer is a Schmitt Trigger input when configured as the external interrupt.
2: This buffer is a Schmitt Trigger input when used in Serial Programming mode.
3: This buffer is a Schmitt Trigger input when configured in RC oscillator mode and a CMOS input otherwise.

1.2. Memory Organisation

There are two memory blocks in the PIC16F84A. These are the program memory and the data memory. Each block has its own bus, so that access to each block can occur during the same oscillator cycle. The data memory can further be broken down into the general purpose RAM and the Special Function Registers (SFRs). The operation of the SFRs that control the "core" are described here. The SFRs used to control the peripheral modules The data memory area also contains the data EEPROM memory. This memory is not directly mapped into the data memory, but is indirectly mapped. That is, an indirect address pointer specifies the address of the data EEPROM memory to read/write. The 64 bytes of data. EEPROM memory have the address range 0h 3Fh.See Figure 1.2.

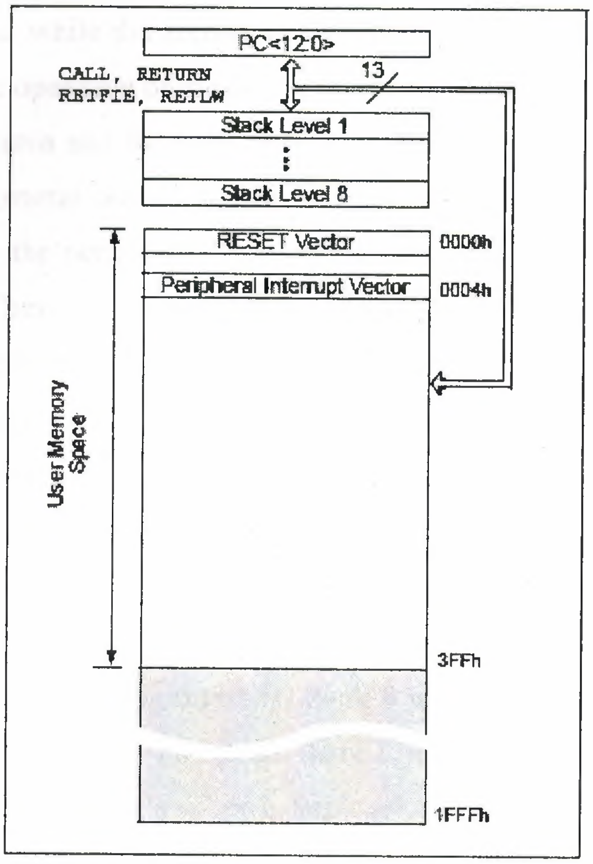


Figure 1.2. Memory Organisation of 16F84A

1.3. Program Memory Organisation

The PIC16FXX has a 13-bit program counter capable of addressing an 8K x 14 program memory space. For the PIC16F84A, the first 1K x 14 (0000h-03FFh) are physically implemented (Figure 2-1). Accessing a location above the physically implemented address will cause a wraparound. For example, for locations 20h, 420h, 820h, C20h, 1020h, 1420h, 1820h, and 1C20h, the instruction will be the same. The RESET vector is at 0000h and the interrupt vector is at 0004h.See Figure 1.26

1.4 Data Memory Organisation

The data memory is partitioned into two areas. The first is the Special Function Registers (SFR) area, while the second is the General Purpose Registers (GPR) area. The SFRs control the operation of the device. Portions of data memory are banked. This is for both the SFR area and the GPR area. The GPR area is banked to allow greater than 116 bytes of general purpose RAM. The banked areas of the SFR are for the registers that control the peripheral functions. Banking requires the use of control bits for bank selection. These control bits are located in the STATUS Register. Figure 1-4 shows the data memory map organization. Instructions MOVWF and MOVF can move values from the W register to any location in the register file ("F"), and vice-versa. The entire data memory can be accessed either directly using the absolute address of each register file or indirectly through the File Select Register (FSR) (Section 2.5). Indirect addressing uses the present value of the RP0 bit for access into the banked areas of data memory. Data memory is partitioned into two banks which contain the general purpose registers and the special function registers. Bank 0 is selected by clearing the RP0 bit (STATUS<5>). Setting the RP0 bit selects Bank 1. Each Bank extends up to 7Fh (128 bytes). The first twelve locations of each Bank are reserved for the Special Function Registers. The remainder are General Purpose Registers, implemented as static RAM. See Figure 1.4

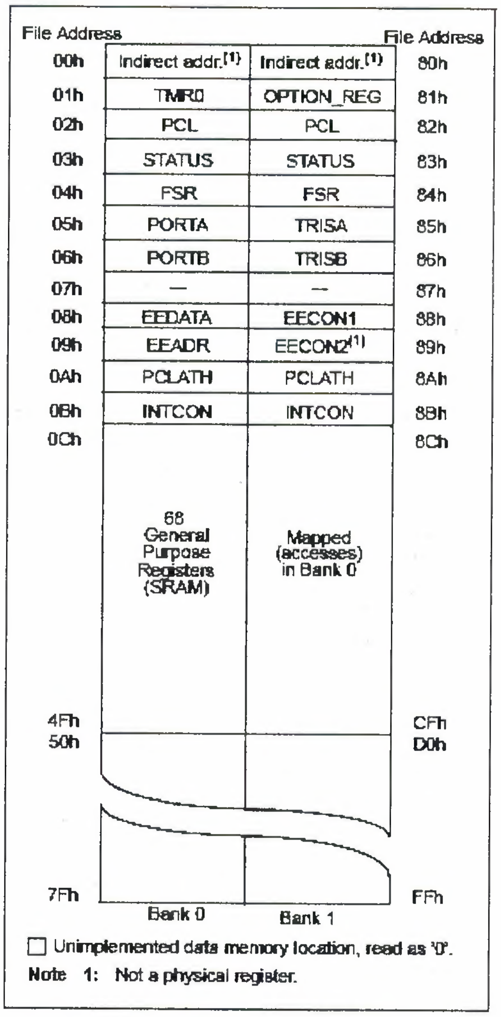


Figure 1.4 Data Memory Organisation of 16F84A

1.5 Programming 16F84A

The Pic16F84 is microcomputer and it is programmed using a *.hex (hexadecimal) file.The *.hex file is created using Pic Basic program.

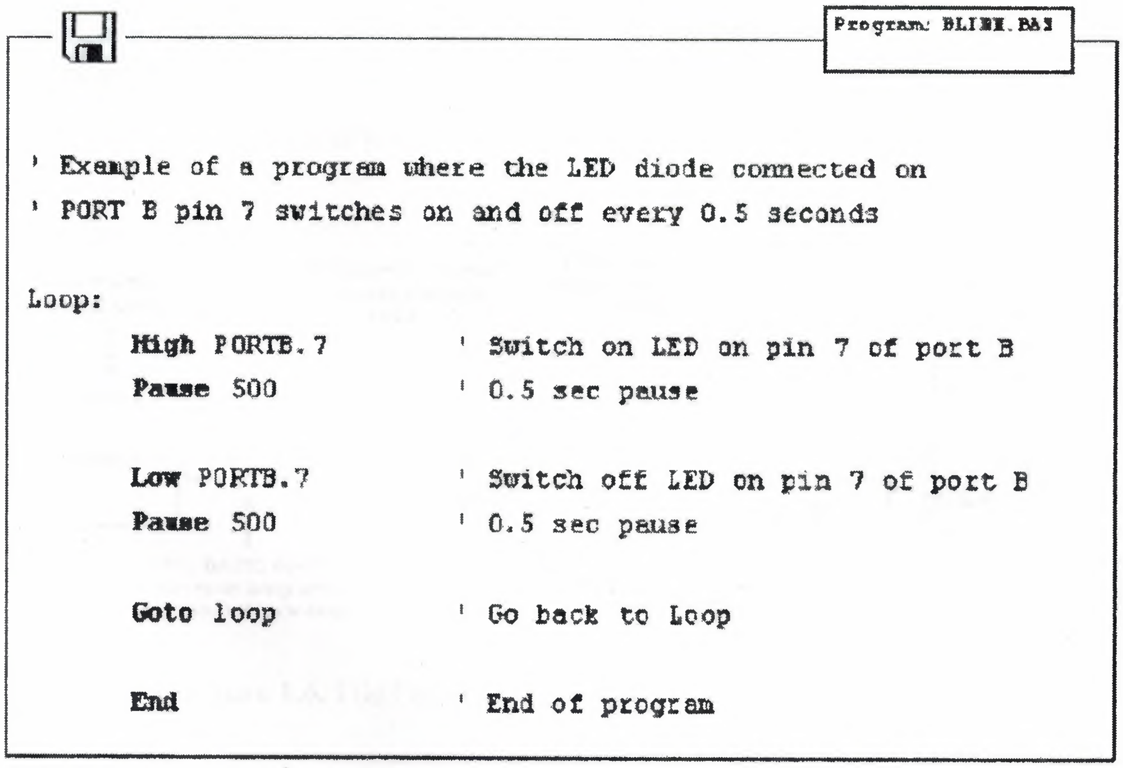
"The Pic Basic Pro" program is written by microchip company that produces the Pic series of microcontrollers. Pic Basic Pro Compiler is "BASIC StampII like" and has some libraries and functions of "Basic program". The following commands are known by Pic Basic Compiler

@
ASM..ENDASM
ADCIN
BRANCH
BRANCHL
BUTTON

CALL
CLEAR
CLEARWDT
COUNT
DATA
DTMFOUT
EEPROM
END
FREQOUT
FOR-NEXT
GOSUB
GOTO
HIGH
HSERIN
HPWM
HSEROUT
I2CREAD
I2CWRITE
INPUT
IF-THEN-ELSE
LCDOUT
LCDIN
{LET}
LOOKDOWN
LOOKDOWN2
LOOKUP
LOOKUP2
LOW
NAP
OUTPUT
OWIN
OWOUT
PAUSE
PAUSEUS
POT
PULSIN
PULSOUT
PWM
RANDOM
RCTIME
READ
READCODE
RETURN
REVERSE
SELECT-CASE
SERIN
SERIN2
SEROUT

SEROUT2
SHIFTIN
SHIFTOUT
SLEEP
SOUND
STOP
SWAP
TOGGLE
WRITE
WRITECODE
WHILE-WEND

The first step is the writing of a program code in some of enumerated text editors. Every written code must be saved on a single file with the ending .BAS exclusively as ASCII text. An example of one simple BASIC program - BLINK.BAS is shown in Figure 1.5



```
' Example of a program where the LED diode connected on
' PORT B pin 7 switches on and off every 0.5 seconds

Loop:
        High PORTB.7        ' Switch on LED on pin 7 of port B
        Pause  500          ' 0.5 sec pause

        Low PORTB.7         ' Switch off LED on pin 7 of port B
        Pause  500          ' 0.5 sec pause

        Goto loop           ' Go back to Loop

        End                 ' End of program
```

Figure 1.5 An Example Written in Basic

When the original BASIC program is finished and saved as a single file with .BAS ending it is necessary to start PIC BASIC compiler. The compiling procedure takes place in two consecutive steps.

Step 1. In the first step compiler will convert BAS file in assembler s code and save it as BLINK.ASM file.

Step 2. In the second step compiler automatically calls assembler, which converts ASM - type file into an executable HEX code ready for reading into the programming memory of a microcontroller. The transition between first and second step is for a user - programmer an invisible one, as everything happens completely automatically and is thereby wrapped up as an indivisible process. In case of a syntax error of a program code, the compilation will not be successful and HEX file will not be created at all. Errors must be then corrected in original BAS file and repeat the whole compilation process. The best tactics is to write and test small parts of the program, than write one gigantic of 1000 lines or more and only then embark on error finding. As a result of a successful compilation of a PIC BASIC program the following files will be created.

- BLINK.ASM - assembler file
- BLINK.LST - program listing
- BLINK.MAC - file with macros
- BLINK.HEX - executable file which is written into the programming memory

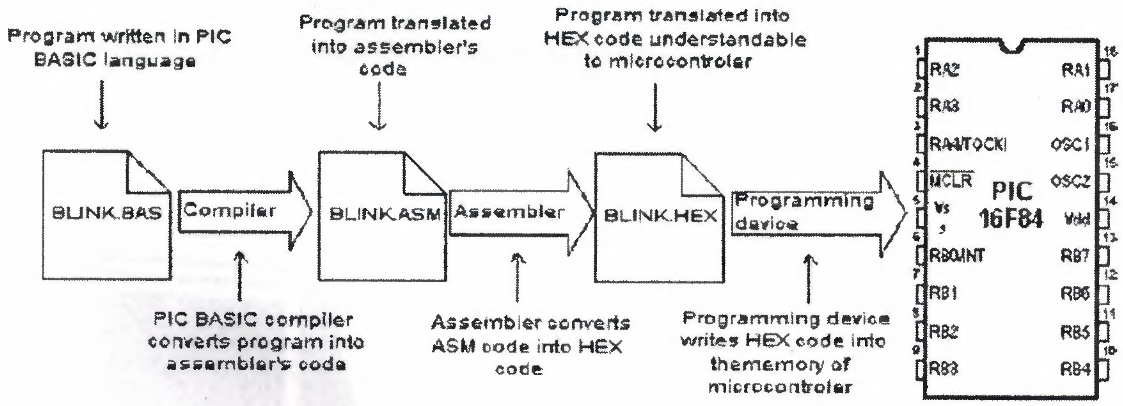
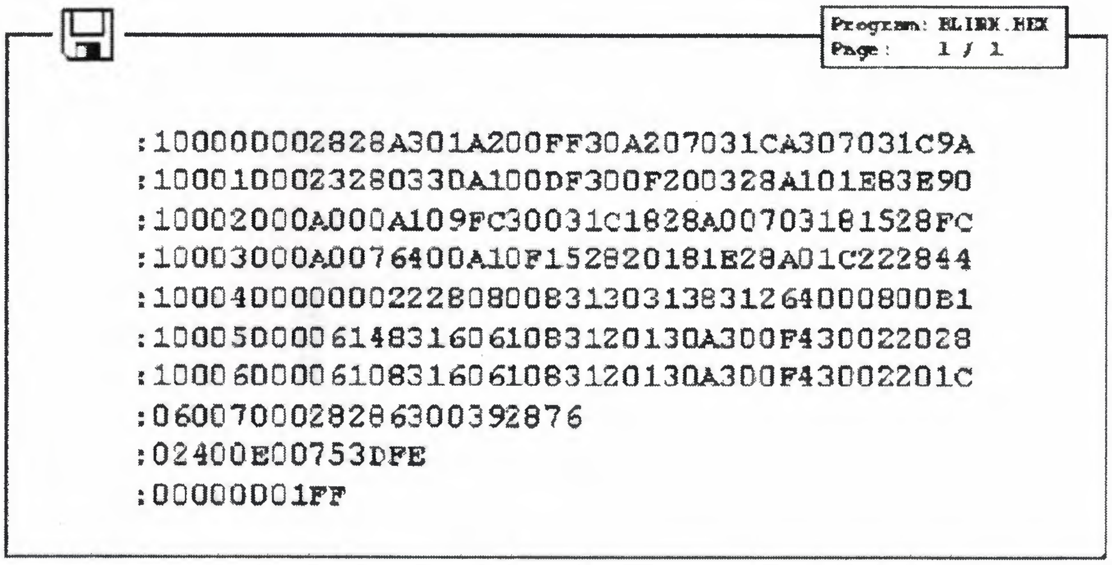

Program written in PIC BASIC language
Program translated into assembler's code
Program translated into HEX code understandable to microcontroler
BLINK.BAS
Compiler
BLINK.ASM
Assembler
BLINK.HEX
Programming device
PIC BASIC compiler converts program into assembler's code
Assembler converts ASM code into HEX code
Programming device writes HEX code into thememory of microcontroler
PIC 16F84
RA2
RA3
RA4/TOCKI
MCLR
Vss
RB0/INT
RB1
RB2
RB3
RA1
RA0
OSC1
OSC2
Vdd
RB7
RB6
RB5
RB4

Figure 1.6. File Conversion for Programming a PIC16F84A

File with the HEX ending is in effect the program that is written into the programming memory of a microcontroller. The programming device with accessory software installed on the PC is used for this operation. Programming device is a contrivance in charge of writing physical contents of a HEX file into the internal memory of a microcontroller. The PC software reads HEX file and sends to the programming device the information about an exact location onto which a certain value is to be inscribed in the programming memory. PIC BASIC creates HEX file in a standard 8-bit Merged

Intel HEX format accepted by the vast majority of the programming software. In Figure 1.30 contents of a file BLINK.HEX is given.



Program: BLINK.HEX
Page : 1 / 1

```
:100000002828A301A200FF30A207031CA307031C9A
:10001000232803 30A100DF300F200328A101E83E90
:10002000A000A109FC30031C1828A00703181528FC
:10003000A0076400A10F152820181E28A01C222844
:100040000000222808008313031383126400080OB1
:100050000061483160610831201 30A300F4300220 28
:100060000061083160610831201 30A300F43002201C
:060070002828630039 2876
:02400E00753DFE
:00000001FF
```

Figure 1.7. A Hexadecimal File

Besides reading of a program code into the programming memory, the programming device serves to set the configuration of a microcontroller. Here belongs the type of the oscillator, protection of the memory against reading, switching on of a watchdog timer etc. The connection between PC, programming device and the microcontroller is shown in Figure 1.8.

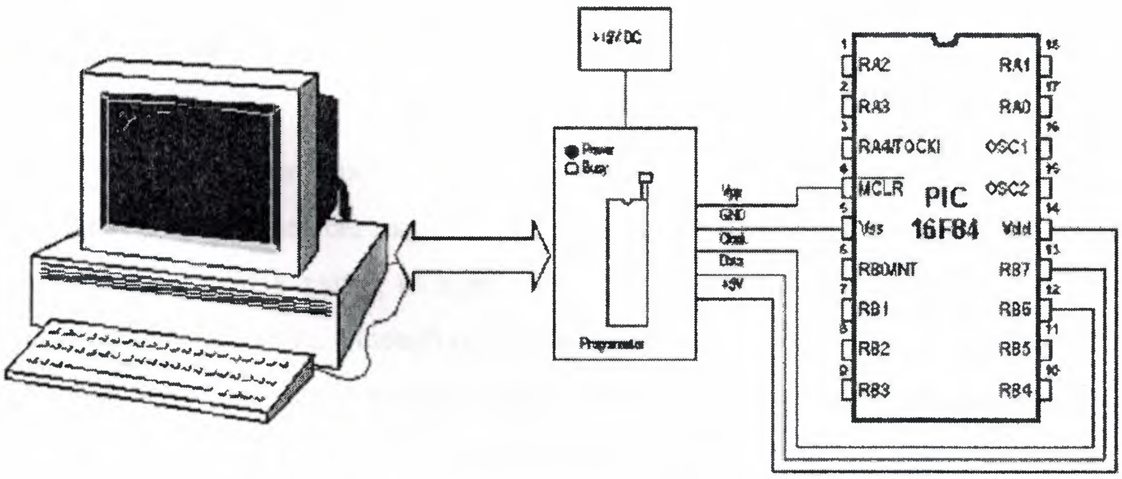
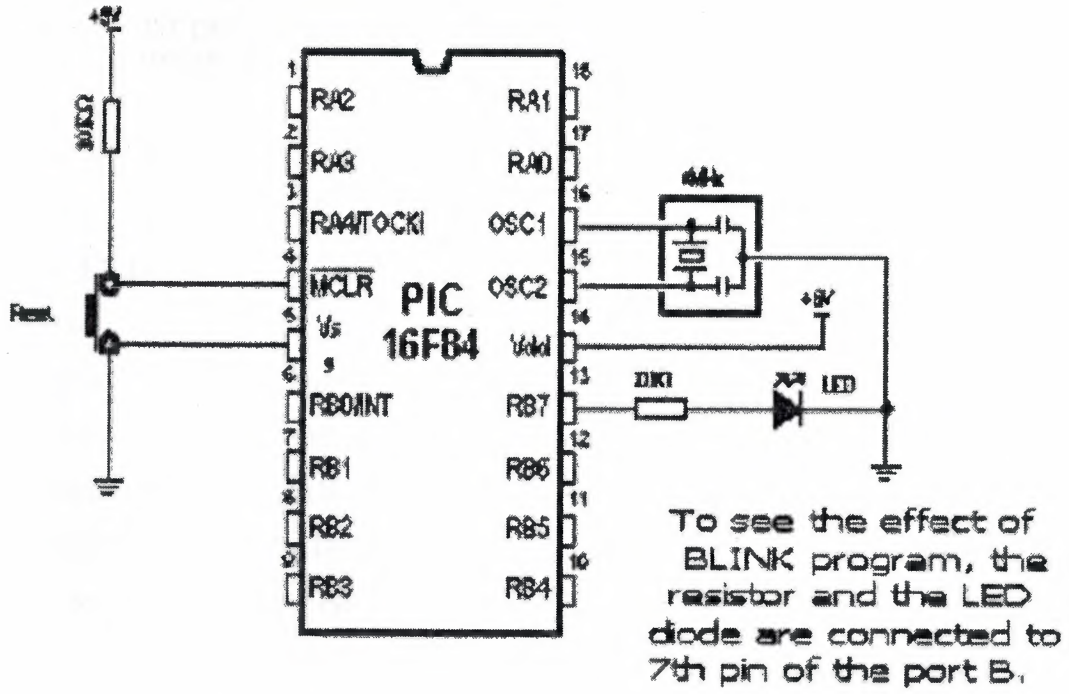


Figure 1.8. Programming a PIC16F84A

1.6 Running The Program

For correct operating of a microcontroller, i.e. correct running of a program it is necessary to assure the supply of the microcontroller, oscillator and the reset circuit. See Figure 1.9.



To see the effect of BLINK program, the resistor and the LED diode are connected to 7th pin of the port B.

Figure 1.9. Pin Connections and Maintenance of 16F84A

1.7 Dotmatrix LCD

A Dot Matrix Display is a display device used to display information on machines and other devices requiring a simple display device of limited resolution. The display consists of a matrix of lights arranged in a rectangular configuration (other shapes are also possible, although not common) such that by switching on selected ones of the lights text or simple graphics can be displayed. A dot matrix controller converts instructions from a processor into signals to particular lights in the matrix such that the required display is produced. Configuration of a dot matrix display is shown Figure 1.7.

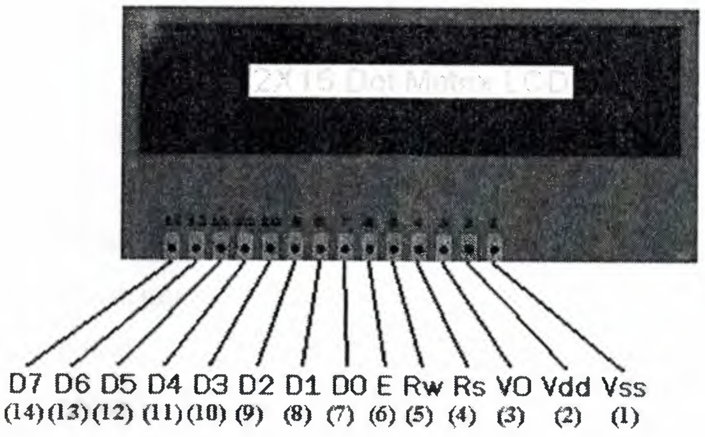


Figure 1.10. A Dot Matrix Display

1.7.1 Controlling The 16F84A

First of all a program has to be loaded to the16F84A. Since our desire is to generate a three phase voltage with adjustable frequency between 50Hz-100Hz, the written program must give 3 signals each 120 degree between and reverse of them, to drive the TLP250s, accordingly the IRG4PH40KD and the inductive load. Lets design the circuit.

- In order to connect the LCD wee need 6 ports.
- To generate three phases and reverse of them, we need 6 ports of the 16F84A.
- In order to generate an interface to the user to be capable of changing the frequency ,we need at least 1 port. Since 16F84A has totaly 13 ports. We have only one port that can be assigned for the user interface.

The arrangment of the ports is as following (maybe changed) ;

PORTA.0 reserved for the LCD (Default for LCD connection.No need to declare inthe prog.)

PORTA.1 reserved for the LCD (Default for LCD connection.No need to declare inthe prog.)

PORTA.2. reserved for the LCD (Default for LCD connection.No need to declare inthe prog.)

PORTA.3 reserved for the LCD (Default for LCD connection.No need to declare inthe prog.)

PORTA.4	reserved for the LCD (Default for LCD connection.No need to declare inthe prog.)
PORTB.3	reserved for the LCD (Default for LCD connection.No need to declare inthe prog.)
PORTB.0	1. phase
PORTB.1	1. phase inverse
PORTB.2	2. phase
PORTB.4	2. phase inverse
PORTB.5	3. phase
PORTB.6	3. phase inverse
PORTB.7	Assigned for the user interface(changing the frequency)

2. MICRO COD STUDIO

2.1 General Explanation

We have much more diffrent program for program and control the pic.Assembly language is so complex because of this many students didnt learn to program microcontrollers.This nice program help us to program.Our language is Pic Basic pro to use micro code studio.This program have a easy control firs write the program with use pic basic code then compile the program.ıt is enough to work.This program change the pic basic codde to hex code.Then I use to install this code to my pic.**ıc prog** program.
Be attention to install the program,dont forget to put **pbp240full doc.** in your pc. Becase This program can not work before to see pbp 240full doc. in your pc.

2.1.1 File Menu

- **New** - Creates a new document. A header is automatically generated, showing information such as author, copyright and date. To toggle this feature on or off, or edit the header properties, you should select editor options. When a new document is created, the default target processor device is set to the 16F877. To change the default, edit the file 'default.ini', located in your main installation folder. You need to restart MicroCode Studio after making the changes.

- **Open** - Displays a open dialog box, enabling you to load a document into the MicroCode Studio IDE. If the document is already open, then the document is made the active editor page.
- **Save** - Saves a document to disk. This button is normally disabled unless the document has been changed. If the document is 'untitled', a *save as* dialog is invoked. A *save as* dialog is also invoked if the document you are trying to save is marked as read only.
- **Save As** - Displays a save as dialog, enabling you to name and save a document to disk.
- **Close** - Closes the currently active document
- **Close All** - Closes all editor documents and then creates a new editor document.
- **Reopen** - Displays a list of Most Recently Used (MRU) documents.
- **Print Setup** - Displays a print setup dialog.
- **Print Preview** - Displays a print preview window.
- **Print** - Prints the currently active editor page.
- **Exit** - Enables you to exit MicroCode Studio

2.1.2 View Menu

- **Code Explorer** - Display or hide the code explorer window.
- **Serial Communicator** - Displays the Serial Communicator software. For more information, see the online help supplied with Serial Communicator.
- **Loader** - Displays the MicroCode Loader application. This option is only available with MicroCode Studio Plus.
- **Loader Options** - Displays the MicroCode Loader options dialog. This option is only available with MicroCode Studio Plus.
- **Toolbars** - Display or hide the main, edit, compile and program and ICD toolbars.
- **Compile and Program Options** - Displays the Compile and Program Options dialog.
- **Editor Options** - Displays the main editor options dialog.
- **Toolbars** - Changes toolbar icon size and colors.
- **Online Updates** - Checks for online updates.

2.1.3 Project Menu

- **Compile** - Selecting this option will compile the currently active editor page.
- **Compile and Program** - Selecting this option will compile the currently active editor page and then automatically start your chosen programmer.
- **Program** - Automatically start your chosen programmer.
- **ICD Compile** - Selecting this option will compile the currently active editor page with debugging information.
- **ICD Compile and Program** - Selecting this option will compile the currently active editor page with debugging information and then automatically start your chosen programmer.

3. PIC BASIC PRO PROGRAMMING

3.1 Information about Pic BasicPro

3.1.1. Introduction

The PicBasic Pro Compiler (or PBP) is our next-generation programming language that makes it even quicker and easier for you to program Microchip Technology's powerful PICmicro microcontrollers (MCUs). The English-like BASIC language is much easier to read and write than the quirky Microchip assembly language. The PicBasic Pro Compiler is "BASIC Stamp II like" and has most of the libraries and functions of both the BASIC Stamp I and II. Being a true compiler, programs execute much faster and may be longer than their Stamp equivalents.PBP is not quite as compatible with the BASIC Stamps as our original PicBasic Compiler is with the BS1. Decisions were made that we hope improve the language overall. One of these was to add a real **IF..THEN..ELSE..ENDIF** instead of the **IF..THEN(GOTO)** of the Stamps. These differences are spelled out later in this manual. PBP defaults to create files that run on a PIC16F84-04/P clocked at 4MHz. Only a minimum of other parts are necessary: 2 22pf capacitors for the 4MHz crystal, a 4.7K pull-up resistor tied to the /MCLR pin and a suitable 5- volt power supply. Many PICmicro MCUs other than the 16F84, as well as oscillators of frequencies other than 4MHz, may be used with the PicBasic Pro Compiler.

3.1.1.1. The PICmicro MCUs

The PicBasic Pro Compiler produces code that may be programmed into a wide variety of PICmicro microcontrollers having from 8 to 84 pins and various on-chip features including A/D converters, hardware timers and serial ports. The current version of the PicBasic Pro Compiler supports all the Microchip Technology PICmicro MCUs, including the 12-bit core, 14-bit core and both 16-bit core series, the 17Cxxx and 18Cxxx devices, as well as the Micromint PicStics. Limited support has been added for PICmicro MCUs based on the original 12-bit core. Support is limited as the 12-bit core PICmicro MCUs have a limited set of resources including a smaller stack and smaller code page size. See the READ.ME file for the very latest PICmicro MCU support list.
For general purpose PICmicro MCU development using the PicBasic Pro Compiler, the PIC16F628, 16F84, 16F876 and 16F877 are the current PICmicro MCUs of choice. These microcontrollers use flash technology to allow rapid erasing and reprogramming to speed program debugging. With the click of the mouse in the programming software, the flash PICmicro MCU can be instantly erased and then reprogrammed again and again. Other PICmicro MCUs in the 12C5xx, 12C67x, 14C000, 16C4xx, 16C5x, 16C55x, 16C6xx, 16C7xx, 16C9xx, 17Cxxx and 18Cxxx series are either one-time programmable (OTP) or have a quartz window in the top (JW) to allow erasure by exposure to ultraviolet light for several minutes.
The PIC16F628, 16F84 and 16F87x devices also contain between 64 and 256 bytes of non-volatile data memory that can be used to store program data and other parameters even when the power is turned off.
This data area can be accessed simply by using the PicBasic Pro Compiler's **READ** and **WRITE** commands. (Program code is always permanently stored in the PICmicro MCU's code space whether the power is on or off.) By using a flash PICmicro MCU for initial program testing, the debugging process may be sped along. Once the main routines of a program are operating satisfactorily, a PICmicro MCU with more capabilities or expanded features of the compiler may be utilized. While many PICmicro MCU features will be discussed in this manual, for full PICmicro MCU information it is necessary to obtain the appropriate PICmicro MCU data sheets or the CD-ROM from Microchip Technology. Refer to Appendix F for contact information.

3.1.1.2. About This Manual

This manual cannot be a full treatise on the BASIC language. It describes the PicBasic Pro Compiler instruction set and provides examples on how to use it. If you are not familiar with BASIC programming, you should acquire a book on the topic. Or just jump right in. BASIC is designed as an easy-to-use language. Try a few simple commands to see how they work. Or start with the examples and then build on them.
The next section of this manual covers installing the PicBasic Pro Compiler and writing your first program. Following is a section that describes different options for compiling programs. Programming basics are covered next, followed by a reference section listing each PicBasic Pro command in detail. The reference section shows each command prototype, a description of the command and some examples. Curly brackets, {}, indicate optional parameters.
The remainder of the manual provides information for advanced programmers - the inner workings of the compiler.

3.1.1.3. Sample Programs

Example programs to help get you started can be found in the SAMPLES subdirectory. Additional example programs can be found in the sample programs section.

EXAMPLE 1 :

```
' PicBasic Pro program to demonstrate the Div32 command.
' Div32 must be used immediately after a multiply statement
' in order to retain the state of the internal registers of
' the device.

' Define Debug pin

DEFINE DEBUG_REG     PORTC
DEFINE DEBUG_BIT     6
DEFINE DEBUG_BAUD    9600
DEFINE DEBUG_MODE    1


' Define variables for testing the command
WRESULT         VAR   WORD        ' Used to store results to a word
EXPECTED   VAR   WORD          ' Used to display the expected result
BRESULT          VAR          BYTE ' Used to store results to a byte
bogus        VAR          BYTE ' Used to store intermediate results of the multiply

BB0              VAR          BYTE ' Data in byte form
BB1              VAR          BYTE ' Data in byte form
WW0              VAR          WORD         ' Data in word form
WW1              VAR          WORD         ' Data in word form



' Set values for testing
BB0=25
BB1=250
WW0=255
WW1=10052

Debug 10,13                    ' Send new line

bogus = WW0 * WW1              ' Multiply to load internal registers with 32-bit
value
WRESULT = Div32 BB1            ' Divide 32-bit value by byte and store in word
EXPECTED = 10253          ' Expected result for this calculation
GoSub resultword          ' Send the result with Debug

bogus = WW0 * WW1              ' Multiply to load internal registers with 32-bit
value
WRESULT = Div32 WW0            ' Divide 32-bit value by word and store in word
EXPECTED = 10052          ' Expected result for this calculation
GoSub resultword          ' Send the result with Debug
```

```
bogus = WW0 * WW1               ' Multiply to load internal registers with 32-bit
value
WRESULT = Div32 1000     ' Divide 32-bit value by contant and store in word
EXPECTED = 2563                 ' Expected result for this calculation
GoSub resultword                ' Send the result with Debug


bogus = BB0 * BB1         ' Multiply to load internal registers with 32-bit value
BRESULT = Div32 BB0             ' Divide 32-bit value by byte and store in byte
EXPECTED = 250                  ' Expected result for this calculation
GoSub resultbyte          ' Send the result with Debug

bogus = BB0 * BB1         ' Multiply to load internal registers with 32-bit value
BRESULT = Div32 WW0             ' Divide 32-bit value by word and store in byte
EXPECTED = 24                   ' Expected result for this calculation
GoSub resultbyte          ' Send the result with Debug

bogus = BB0 * BB1         ' Multiply to load internal registers with 32-bit value
BRESULT = Div32 100             ' Divide 32-bit value by contant and store in byte
EXPECTED = 62                   ' Expected result for this calculation
GoSub resultbyte          ' Send the result with Debug


Debug 10,13                     ' Send new line

End                                   ' Stop


resultbyte:                     ' Send byte value

        Debug "Byte Result = ",#BRESULT,"    ",#EXPECTED," Expected",10,13
        Pause 500
        Return
```

```
resultword:                             ' Send word value

        Debug "Word Result = ",#WRESULT,"   ",#EXPECTED," Expected",10,13
        Pause 500
        Return
```

EXAMPLE 2:

' EEPROM, READ and WRITE Commands'
' Demonstate commands for EEPROM. Works on PIC16F(C)84 targets only!!!
' Initialized address 0..5 and 9. Writes 10..63. This leaves addesses
' 6..8 undefined (assuming your programmer doesn't unconditionally
' program all EEPROM locations).

```
      Include "modedefs.bas"        ' Include serial modes

SO    con    0                  ' Define serial output pin
B0    var    byte
B1    var    byte
B2    var    byte

EEPROM  ["vwxyz"]                   ' EEPROM[0..4] = 118..122
EEPROM  9,[100]                   ' EEPROM[9] = 100

loop:   B0 = 63                   ' Set Size of EEPROM

        For B1 = 10 To B0             ' Check WRITE Command
           B2 = B1 + 100          ' EEPROM[10..63] = 110..163
           Write B1,B2
        Next B1

        For B1 = 0 To B0              ' Check READ Command
        Read B1,B2            ' Dump EEPROM Contents
        Serout SO,N2400,[#B2," "]
    Next B1
Serout SO,N2400,[10,10]       ' Skip 2 Lines

Goto loop                     ' Forever
```

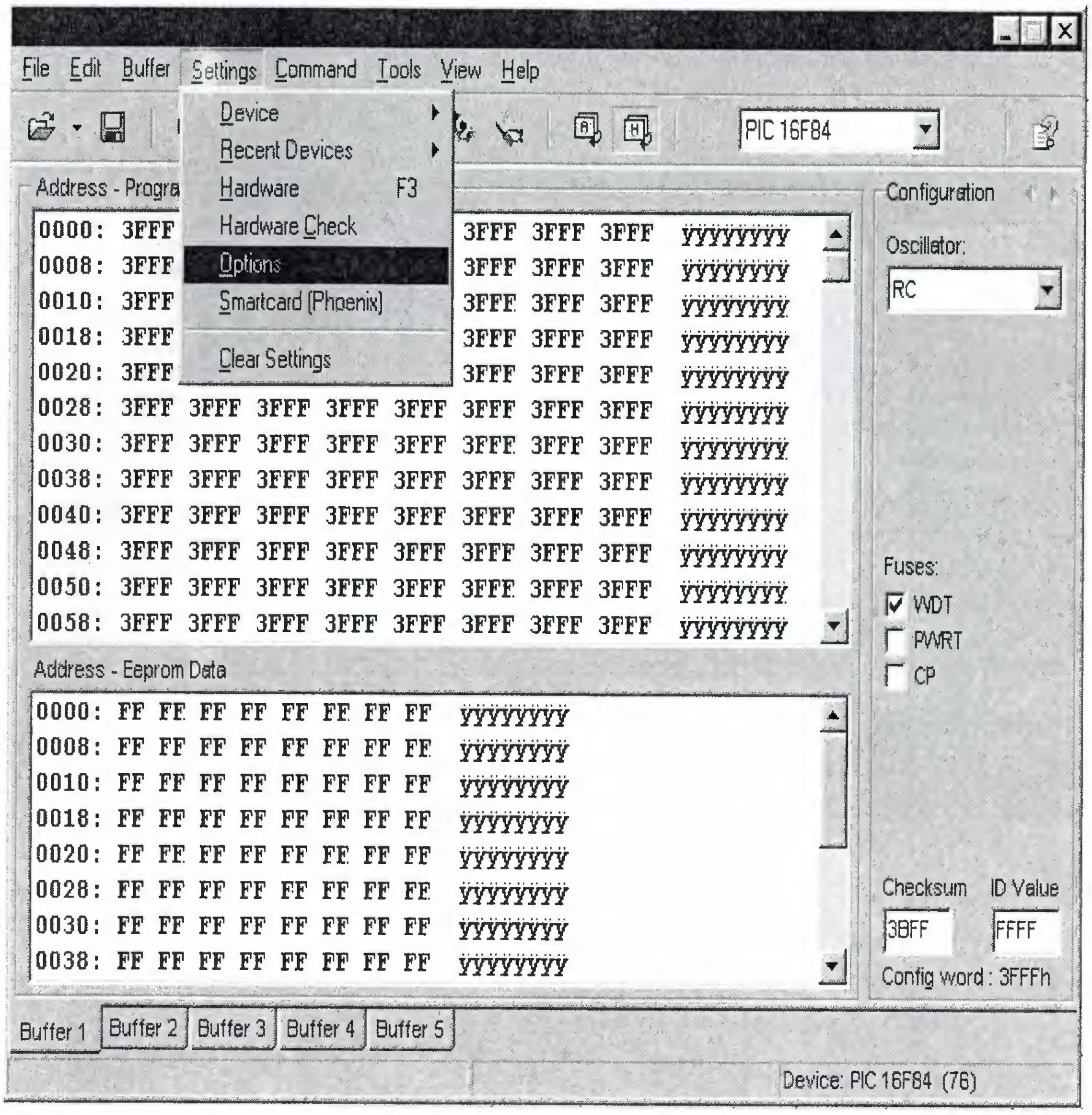
4. IC-PROG PROGRAMMIG

4.1 General Explanation

In this program we have a hex cod from the MicroCod studio.We open this code from the Ic-prog program for install the pic.This is also be easy program but we should attention some part of the program for work.we have some error because of this program can not be work easly.When you seee like this kind of errors you should control all of the set up agin.Dont wory for do same thing when you are correct the set up because many times I see that ıf change and do same set up program can work and get well.

4.1.1 Set Up The Language

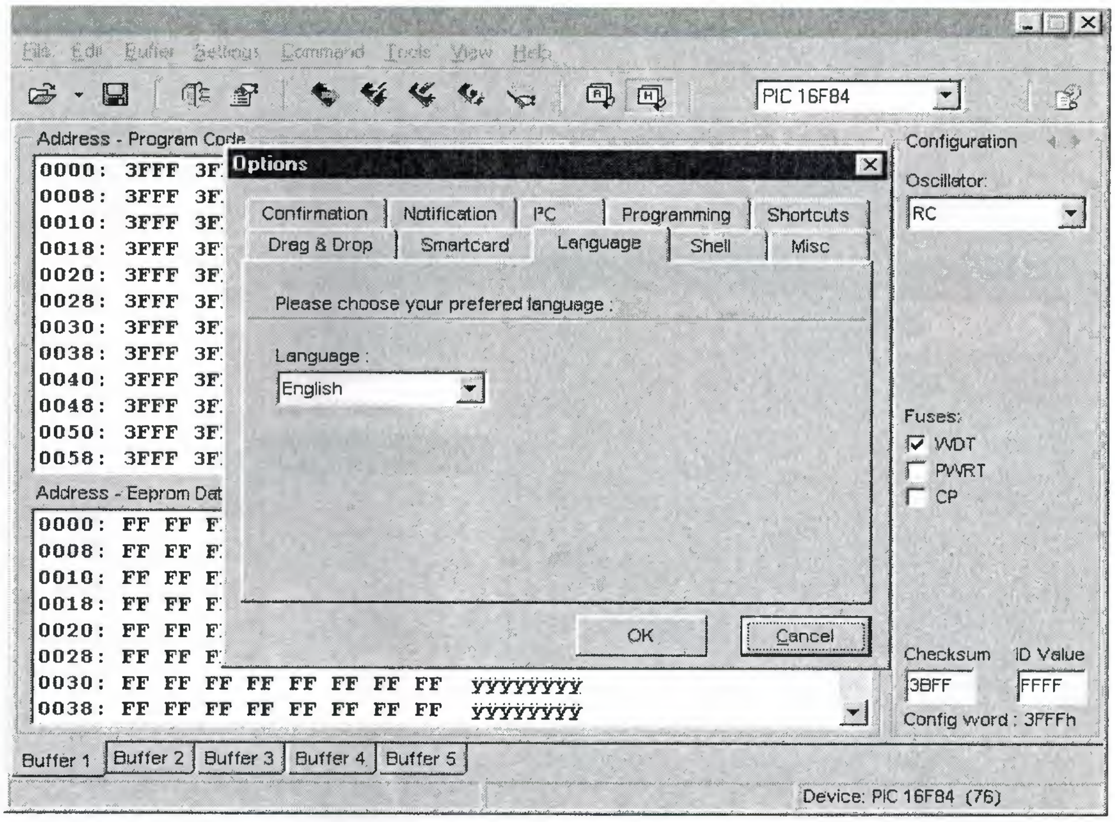
If the language is not Turkısh you can change the language.Setting/Options/Language
After that we come to in side of Language set up



```
0000: 3FFF                          3FFF 3FFF 3FFF  ÿÿÿÿÿÿÿÿ
0008: 3FFF                          3FFF 3FFF 3FFF  ÿÿÿÿÿÿÿÿ
0010: 3FFF                          3FFF 3FFF 3FFF  ÿÿÿÿÿÿÿÿ
0018: 3FFF                          3FFF 3FFF 3FFF  ÿÿÿÿÿÿÿÿ
0020: 3FFF                          3FFF 3FFF 3FFF  ÿÿÿÿÿÿÿÿ
0028: 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF  ÿÿÿÿÿÿÿÿ
0030: 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF  ÿÿÿÿÿÿÿÿ
0038: 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF  ÿÿÿÿÿÿÿÿ
0040: 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF  ÿÿÿÿÿÿÿÿ
0048: 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF  ÿÿÿÿÿÿÿÿ
0050: 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF  ÿÿÿÿÿÿÿÿ
0058: 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF 3FFF  ÿÿÿÿÿÿÿÿ
```

```
0000: FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿ
0008: FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿ
0010: FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿ
0018: FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿ
0020: FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿ
0028: FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿ
0030: FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿ
0038: FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿ
```

Figure 4.1. Ic prog set up



PIC 16F84

Address - Program Code

```
0000:  3FFF  3F
0008:  3FFF  3F
0010:  3FFF  3F
0018:  3FFF  3F
0020:  3FFF  3F
0028:  3FFF  3F
0030:  3FFF  3F
0038:  3FFF  3F
0040:  3FFF  3F
0048:  3FFF  3F
0050:  3FFF  3F
0058:  3FFF  3F
```

Address - Eeprom Dat

```
0000:  FF  FF  F
0008:  FF  FF  F
0010:  FF  FF  F
0018:  FF  FF  F
0020:  FF  FF  F
0028:  FF  FF  F
0030:  FF  FF  FF  FF  FF  FF  FF  FF    ÿÿÿÿÿÿÿÿ
0038:  FF  FF  FF  FF  FF  FF  FF  FF    ÿÿÿÿÿÿÿÿ
```

Please choose your prefered language :

Language : English

Configuration

Oscillator: RC

Fuses:
[✓ WDT]
PWRT
CP

Checksum: 3BFF ID Value: FFFF

Config word : 3FFFh

Device: PIC 16F84 (76)

Figure 4.2 Set up the language

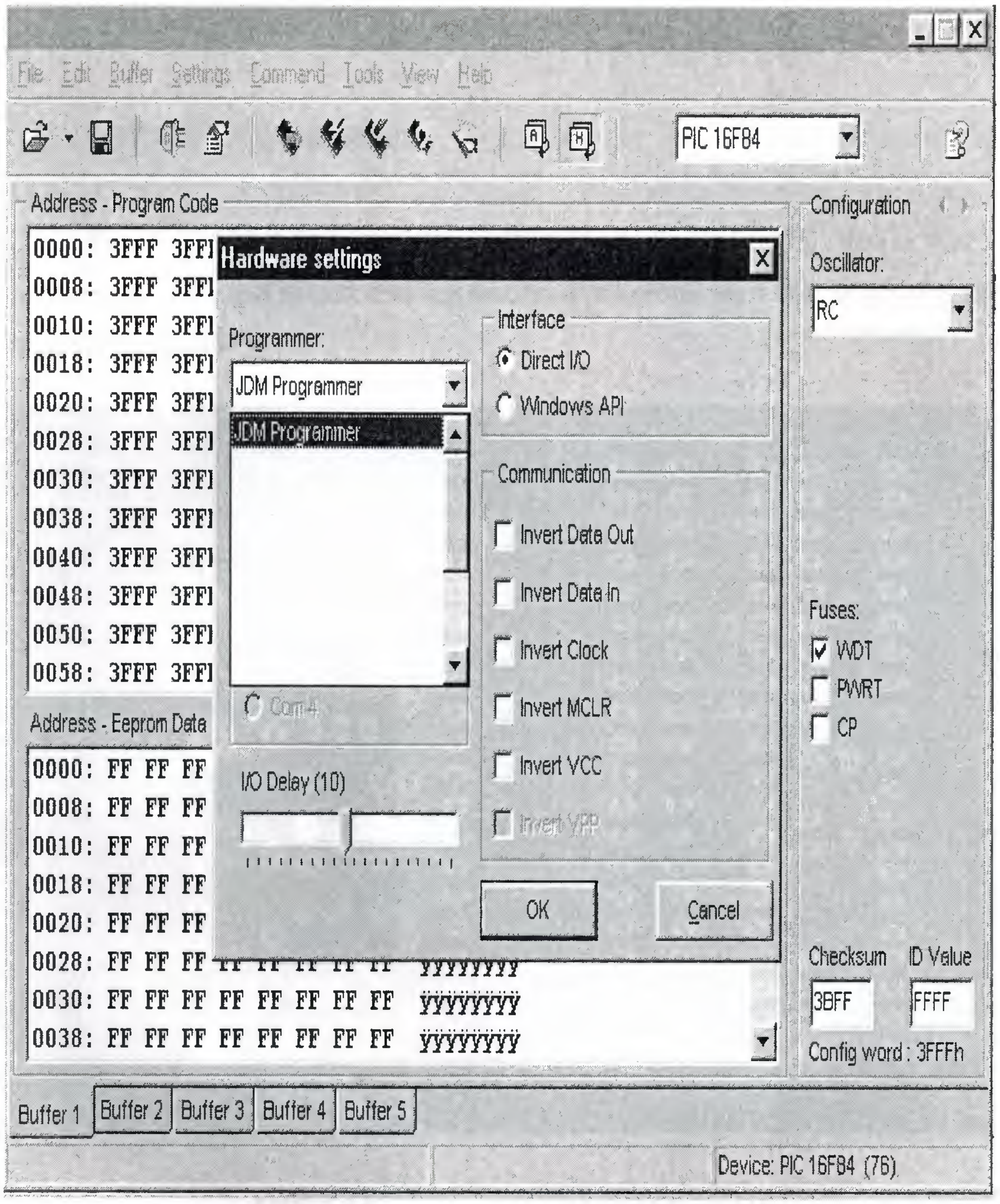
4.1.2 Set Up The Soft Ware

1-Select the JMD PROGRAMMER for programmer

2-Select the Drect I/O from the interface

3-Dont select any communication part

4-Select the port from the part you have to work.



```
0000: 3FFF 3FF
0008: 3FFF 3FF
0010: 3FFF 3FF
0018: 3FFF 3FF
0020: 3FFF 3FF
0028: 3FFF 3FF
0030: 3FFF 3FF
0038: 3FFF 3FF
0040: 3FFF 3FF
0048: 3FFF 3FF
0050: 3FFF 3FF
0058: 3FFF 3FF
```

```
0000: FF FF FF
0008: FF FF FF
0010: FF FF FF
0018: FF FF FF
0020: FF FF FF
0028: FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿ
0030: FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿ
0038: FF FF FF FF FF FF FF FF  ÿÿÿÿÿÿÿÿ
```

Programmer: JDM Programmer

Interface: [✓ Direct I/O] Windows API

Communication: ☐ Invert Data Out ☐ Invert Data In ☐ Invert Clock ☐ Invert MCLR ☐ Invert VCC ☐ Invert VPP

I/O Delay (10)

Oscillator: RC

Fuses: ☑ WDT ☐ PWRT ☐ CP

Checksum 3BFF ID Value FFFF

Config word : 3FFFh

Device: PIC 16F84 (76)

Figure 4.3 Set up the software

5. PIC PROGRAMMING DEVICE

5.1 General Explanation

This device connects the pic to pc.They have some led on this device,When the green led light we understand that connection is succesful after that when we start to program,white led is flash .

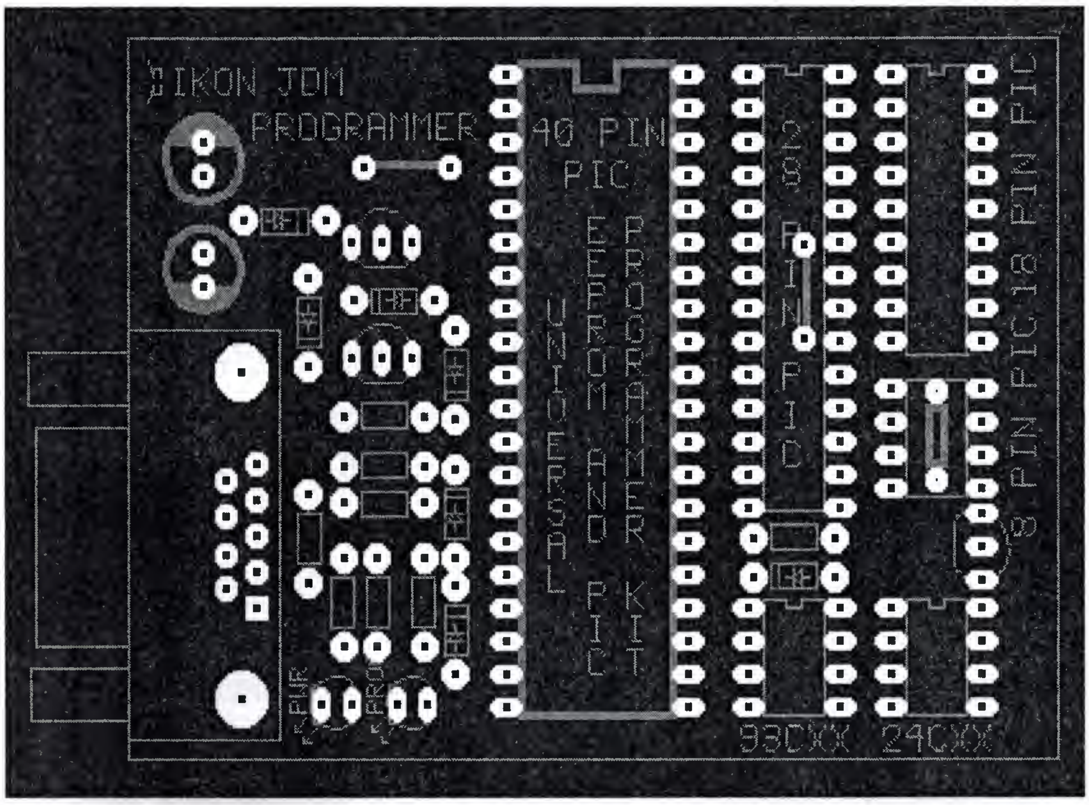


Figure 4.4 Pic Programming Device (inside)

We use 16F84A so we should put this device to the 18 pin board.When you use diffrent device we should put it diffrent place to the board.We can see diffrent kind of bord in the market.When we buy this prodece cd is given.

6. BACKGROUNG OF MYPROJECT

In this project I control the role by my pic.I give some comand which include time relation to work the system.Roles trigger the contactor in the wall panel then the motor is starting to work.

6.1 Relay

6.1.1 The Using Of Relay in My Project

My roles have double contact so that I wire the led and motor wire both part of the role because of this they work at the same time. Then I can see motor working easly while the connection cannot connect the motor.
If I cannot use role the system cannot be worked. because when I give a command to my role ,ıt is only use my command,ıt means ıt can use my command to trigger the 5v which is given out side of the role inside of the role.

6.1.2 Example Of Relay

I want to give interesting example to understand the principles of relay and on the other side you will understant my Project easily.
The relay is an electromechanical device, which transforms an electrical signal into mechanical movement. It consists of a coil of insulated wire on a metal core, and a metal armature with one or more contacts. When a supply voltage was delivered to the coil, current would flow and a magnetic field would be produced that moves the armature to close one set of contacts and/or open another set. When power is removed from the relay, the magnetic flux in the coil collapses and produces a fairly high voltage in the opposite direction. This voltage can damage the driver transistor and thus a reverse-biased diode is connected across the coil to "short-out" the spike when it occurs.

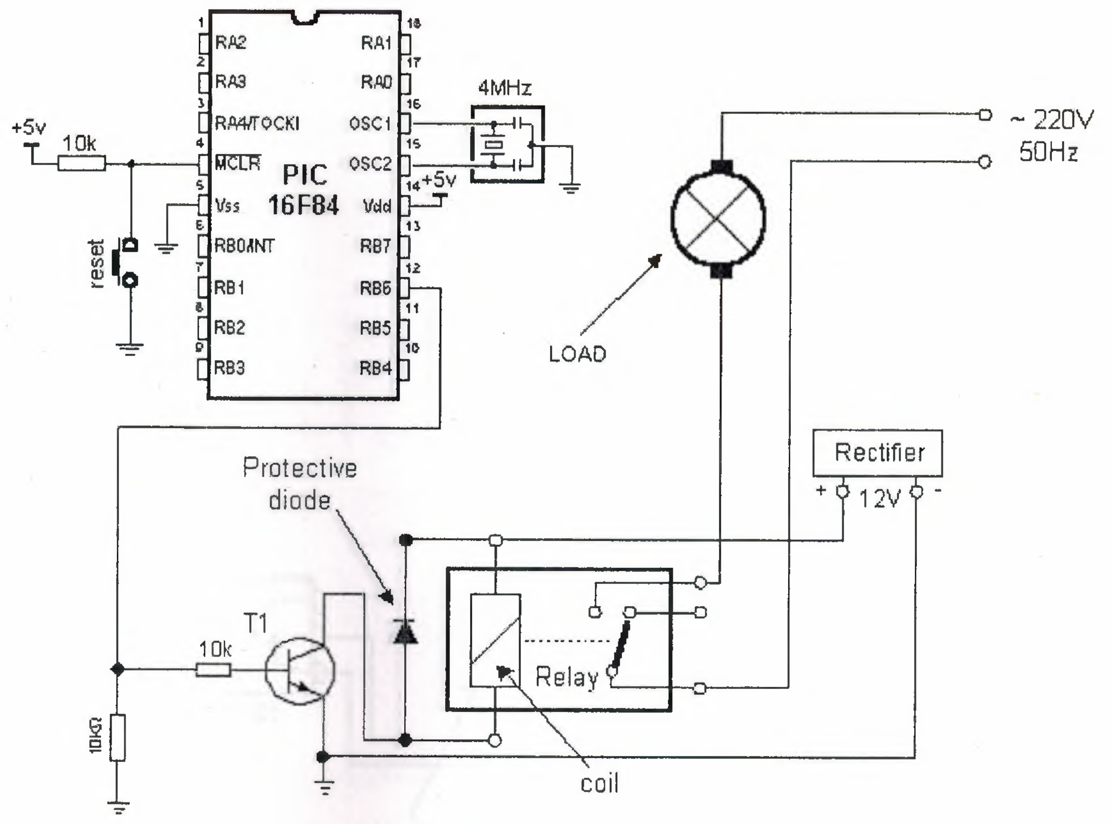


Figure 6.1 Connecting a relay to the microcontroller via transistor

Since microcontroller cannot provide sufficient supply for a relay coil (approx. 100+mA is required; microcontroller pin can provide up to 25mA), a transistor is used for adjustment purposes, its collector circuit containing the relay coil. When a logical one is delivered to transistor base, transistor activates the relay, which then, using its contacts, connects other elements in the circuit. Purpose of the resistor at the transistor base is to keep a logical zero on base to prevent the relay from activating by mistake. This ensures that only a clean logical one on RA3 activates the relay.

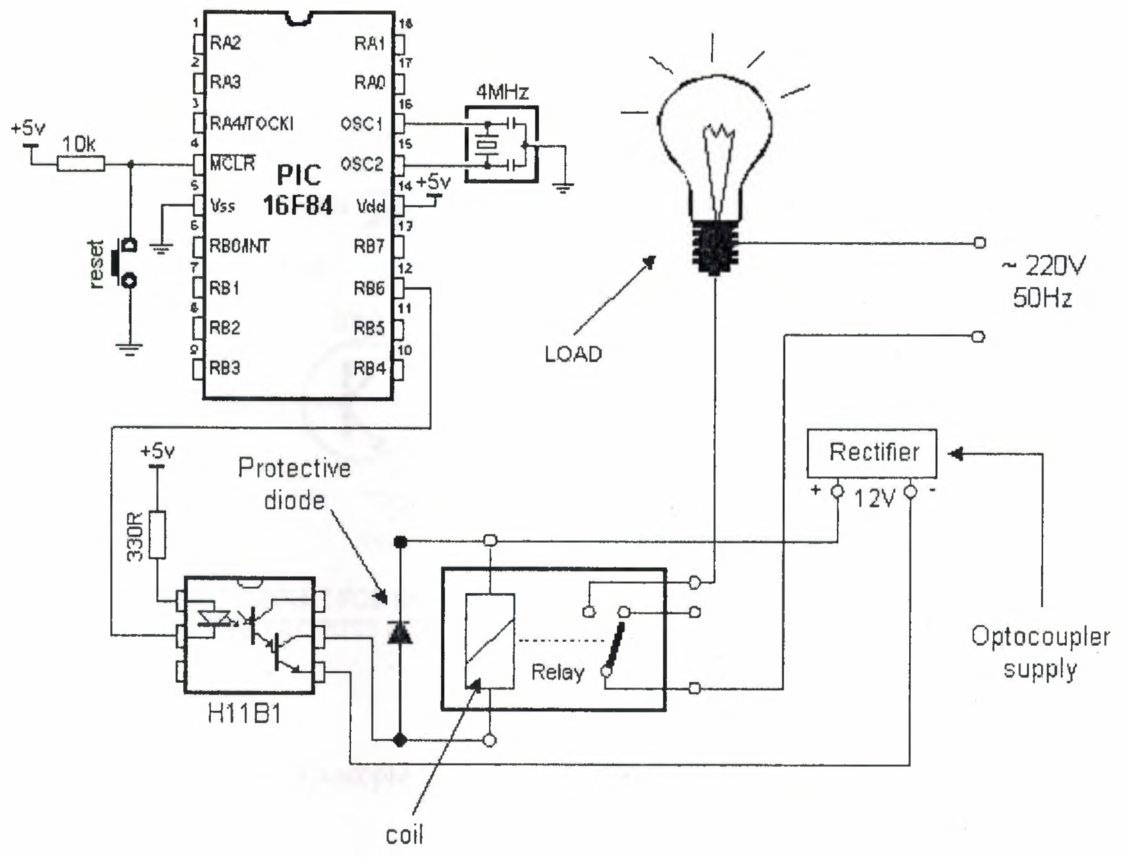


Figure 6.2 Connecting the optocoupler and relay to a microcontroller

A relay can also be activated via an optocoupler which at the same time amplifies the current related to the output of the microcontroller and provides a high degree of isolation. High current optocouplers usually contain a 'Darlington' output transistor to provide high output current.Connecting via an optocoupler is recommended especially for microcontroller applications, where relays are used fro starting high power load, such as motors or heaters, whose voltage instability can put the microcontroller at risk. In our example, when LED is activated on some of the output port pins, the relay is started. Below is the program needed to activate the relay, and includes some of the already discussed

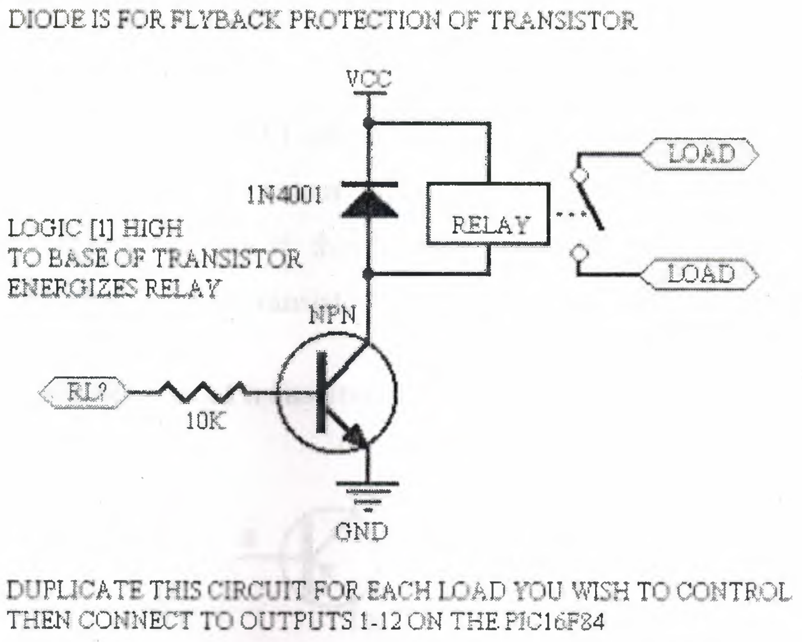

DIODE IS FOR FLYBACK PROTECTION OF TRANSISTOR
VCC
1N4001
RELAY
LOAD
LOAD
LOGIC [1] HIGH
TO BASE OF TRANSISTOR
ENERGIZES RELAY
NPN
RL?
10K
GND
DUPLICATE THIS CIRCUIT FOR EACH LOAD YOU WISH TO CONTROL
THEN CONNECT TO OUTPUTS 1-12 ON THE PIC16F84

Figure 6.3 Different Example for Relay for the pic

Some Hint About Figure 6..3

Figure 6..3 shows how to hookup relays to the PIC16F84. Don't leave out the fly-back protection diode. This diode will save you from damaging your drive transistor when the magnetic field of the relay coil collapses after it's been de-energized.If you need a total of 12 relays, just hookup one of these relay circuits to each of the 12 output-pins shown in the schematic at the top of the page. If you only need a couple relays, just hookup as many as you need. The project will work just fine with up to 12 relays.

Note: Be sure your power supply has enough current capacity to handle the total load of (all) relays being energized at the same time. If you experience problems or erratic behavior with this circuit, check for power loss when all relays are energized. Be sure your power isn't dropping below the minimum operating requirements of the PIC16F84 and causing the PIC to shut-down during operation.

6.2 Transistor

In my system if I cannot use transistor,my project can work,but Transistor give a determination to the system .When I search for my project then I see that most of the projects use transistor if they want to use a role and they connect the transistor before the role.I use BC237 transistor ,this transistor has NPN structure.

6.4 Types of transistor

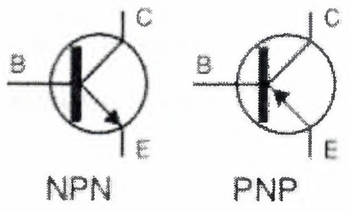


Figure 6.4 Transistor circuit symbols

There are two types of standard transistors, **NPN** and **PNP**, with different circuit symbols. The letters refer to the layers of semiconductor material used to make the transistor. Most transistors used today are NPN because this is the easiest type to make from silicon. If you are new to electronics it is best to start by learning how to use NPN transistors.

The leads are labelled **base** (B), **collector** (C) and **emitter** (E).

These terms refer to the internal operation of a transistor but they are not much help in understanding how a transistor is used, so just treat them as labels!

A Darlington pair is two transistors connected together to give a very high current gain.

In addition to standard (bipolar junction) transistors, there are **field-effect transistors** which are usually referred to as **FETs**. They have different circuit symbols and properties and they are not (yet) covered by this pageç

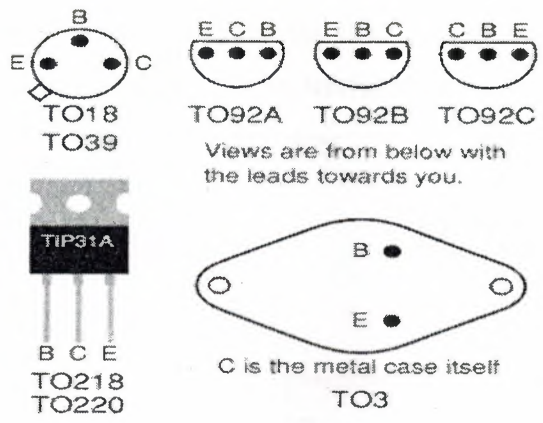

B
E
C
TO18
TO39
E C B
E B C
C B E
TO92A
TO92B
TO92C
Views are from below with the leads towards you.
TIP31A
B C E
TO218
TO220
B
E
C is the metal case itself
TO3

Figure6.5 Transistor leads for some common case styles.

6.2.2 Connecting

Transistors have three leads which must be connected the correct way round. Please take care with this because a wrongly connected transistor may be damaged instantly when you switch on.

If you are lucky the orientation of the transistor will be clear from the PCB or stripboard layout diagram, otherwise you will need to refer to a supplier's catalogue to identify the leads.

6.2.3 Choosing a transistor

Most projects will specify a particular transistor, but if necessary you can usually substitute an equivalent transistor from the wide range available. The most important properties to look for are the maximum collector current I_C and the current gain h_{FE}. To make selection easier most suppliers group their transistors in categories determined either by their **typical use** or **maximum power** rating.

To make a final choice you will need to consult the tables of technical data which are normally provided in catalogues. They contain a great deal of useful information but they can be difficult to understand if you are not familiar with the abbreviations used.

The table below shows the most important technical data for some popular transistors, tables in catalogues and reference books will usually show additional information but this is unlikely to be useful unless you are experienced. The quantities shown in the table are explained below.

Table:6.1 NPN Transistor

NPN transistors								
Code	**Structure**	**Case style**	**I_C max.**	**V_{CE} max.**	**h_{FE} min.**	**P_{tot} max.**	**Category (typical use)**	**Possible substitutes**
BC107	NPN	TO18	100mA	45V	110	300mW	Audio, low power	BC182 BC547
BC108	NPN	TO18	100mA	20V	110	300mW	General purpose, low power	BC108C BC183 BC548
BC108C	NPN	TO18	100mA	20V	420	600mW	General purpose, low power	
BC109	NPN	TO18	200mA	20V	200	300mW	Audio (low noise), low power	BC184 BC549
BC182	NPN	TO92C	100mA	50V	100	350mW	General purpose, low power	BC107 BC182L
BC182L	NPN	TO92A	100mA	50V	100	350mW	General purpose, low power	BC107 BC182
BC547B	NPN	TO92C	100mA	45V	200	500mW	Audio, low power	BC107B
BC548B	NPN	TO92C	100mA	30V	220	500mW	General purpose,	BC108B

							low power	
BC549B	NPN	TO92C	100mA	30V	240	625mW	Audio (low noise), low power	BC109
2N3053	NPN	TO39	700mA	40V	50	500mW	General purpose, low power	BFY51
BFY51	NPN	TO39	1A	30V	40	800mW	General purpose, medium power	BC639
BC639	NPN	TO92A	1A	80V	40	800mW	General purpose, medium power	BFY51
TIP29A	NPN	TO220	1A	60V	40	30W	General purpose, high power	
TIP31A	NPN	TO220	3A	60V	10	40W	General purpose, high power	TIP31C TIP41A
TIP31C	NPN	TO220	3A	100V	10	40W	General purpose, high power	TIP31A TIP41A
TIP41A	NPN	TO220	6A	60V	15	65W	General purpose, high power	
2N3055	NPN	TO3	15A	60V	20	117W	General purpose, high power	

Please note: the data in this table was compiled from several sources which are not entirely consistent! Most of the discrepancies are minor, but please consult information from your supplier if you require precise data.

PNP transistors

Code	**Structure**	**Case style**	**I_C max.**	**V_{CE} max.**	**h_{FE} min.**	**P_{tot} max.**	**Category (typical use)**	**Possible substitutes**
BC177	PNP	TO18	100mA	45V	125	300mW	Audio, low power	BC477
BC178	PNP	TO18	200mA	25V	120	600mW	General purpose, low power	BC478
BC179	PNP	TO18	200mA	20V	180	600mW	Audio (low noise), low power	
BC477	PNP	TO18	150mA	80V	125	360mW	Audio, low power	BC177
BC478	PNP	TO18	150mA	40V	125	360mW	General purpose, low power	BC178
TIP32A	PNP	TO220	3A	60V	25	40W	General purpose, high power	TIP32C
TIP32C	PNP	TO220	3A	100V	10	40W	General purpose, high power	TIP32A

Please note: the data in this table was compiled from several sources which are not entirely consistent! Most of the discrepancies are minor, but please consult information from your supplier if you require precise data.

6.3. Capacitors

A capacitor is an electrical storage component that has the capability of accepting an electrical charge (voltage and current) from a voltage source. This charge can be stored for as long as required and then released. The unit of capacitance is the farad, F, named after Michael Faraday. By definition, a one farad capacitor will charge to one volt in one second with a current of one ampere.In its basic form, a capacitor consists of two conducting metal plates with terminals attached to each plate. Sandwiched between the two metal plates is a nonconducting material called the dielectric. By applying a voltage across the metal plates (terminals) of the capacitor, an electric charge is applied across its dielectric where it is stored until discharged. The polarity of the voltage is maintained across the dielectric until the applied voltage is reversed or the capacitor is discharged.

Capacitance is the measure of the storage capability of a capacitor, and its value is dependent upon the area of the metal plates, the distance between them, and the specific dielectric material between the plates. Figure 1.5 shows construction of a simple resistor.

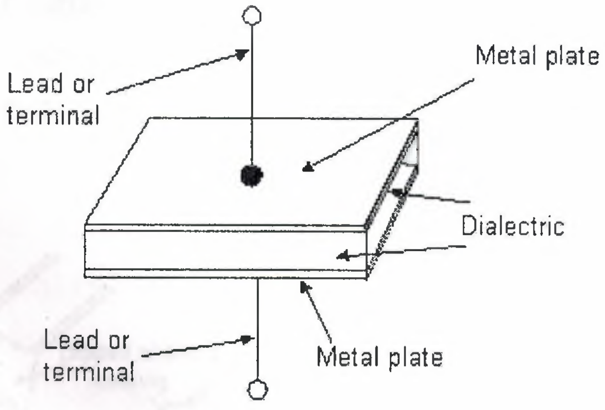


Figure 6.1 Construction of capacitor

6.7 Capacitor Types

Capacitors are categorized as variable non-polarized, fixed non-polarized, and fixed polarized. Their schematic symbols are shown in Figures 1.6. Many varieties of capacitance characteristics exist within each category such as tolerance, voltage capability, temperature range, the capability to withstand environmental stress, package configurations, and process techniques. Different dielectric materials provide unique electrical characteristics required for each type. Figure 1.6 shows symbols of these capacitor types.

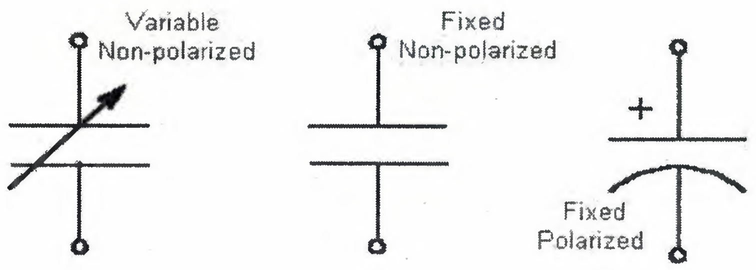


Figure 6.8 Capacitor Symbols

3 different capacitor type are used in this project.

1.Seramic Capacitor (Disc-Monolithic – Non-polarized)

2.Aluminum Electrolytic Capacitor (Polarized)

3.Tantalium Oxide Capacitor (Non-Polarized)

6.3.2 Ceramic Capacitors

This type of capacitors are used in high-frequency coupling and filter application circuits, fast timing circuits, and RF tuned circuits. Capacitance values range from 1pf to 10 □F with voltage breakdown capability up to 50,000 volts.

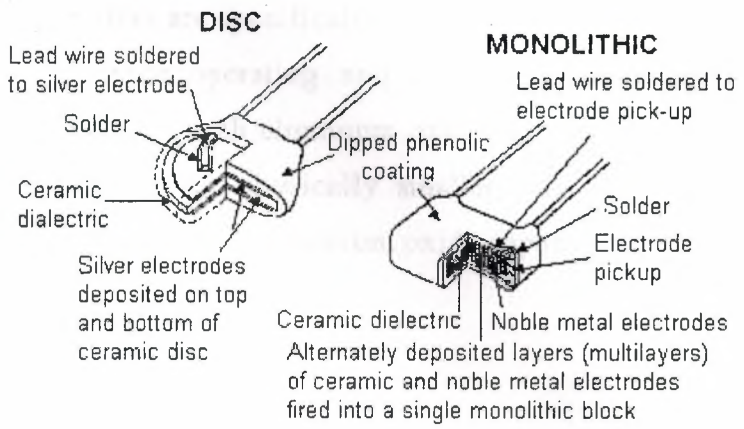

DISC
Lead wire soldered to silver electrode
Solder
Ceramic dialectric
Silver electrodes deposited on top and bottom of ceramic disc
Dipped phenolic coating
MONOLITHIC
Lead wire soldered to electrode pick-up
Solder
Electrode pickup
Ceramic dielectric
Noble metal electrodes
Alternately deposited layers (multilayers) of ceramic and noble metal electrodes fired into a single monolithic block

Figure 6.9 Construction of Capacitors

6.3.3 Aluminum Oxide

This type of capacitors are used in commercial, industrial, and consumer applications in DC filters, low frequency AC filters, and voltage storing circuits, is used over a limited temperature range (-40°C to +85°C). Capacitance values range from 0.1□F to 1 farad. Voltage ratings range from 3 to 500 volts.See Figure 1.8.

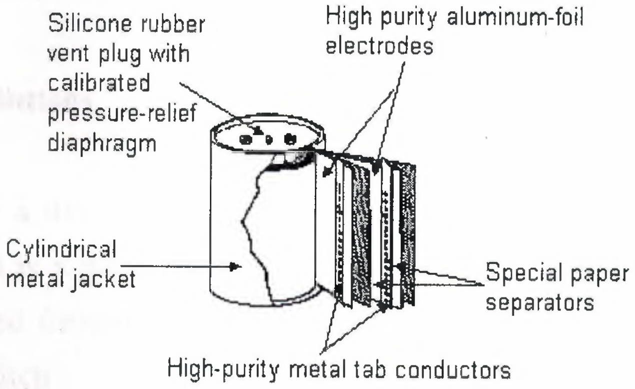

Silicone rubber vent plug with calibrated pressure-relief diaphragm
High purity aluminum-foil electrodes
Cylindrical metal jacket
Special paper separators
High-purity metal tab conductors

Figure 6.10 Construction of Aluminum Oxide Capacitor

6.3.4. Tantalium Oxide Capacitors

Applicable for the same applications as aluminum oxide types. They have approximately the same capacitance and voltage ratings. Tantalum oxide capacitors are specifically intended for military and space applications because of their wide operating and storage temperature range (-55°C to +125°C). In comparison with aluminum oxide capacitor types, they have greater stability and reliability, are physically smaller, but are more expensive.See Figure 1.9 for construction of a tantalium oxide capacitor.

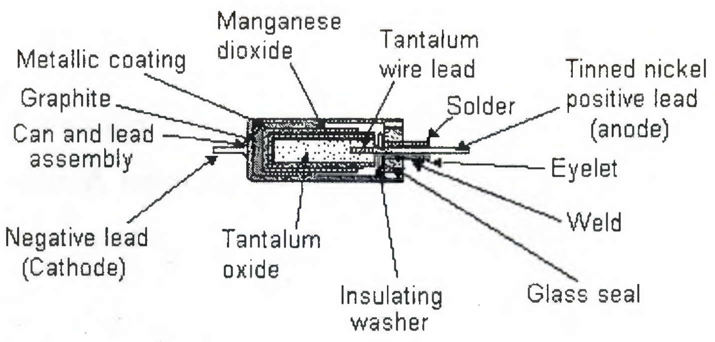


Figure 6.11 Constrution of Aluminum Oxide Capacitor

6.4 Switch Buttons

A switch is a device for changing the course (or flow) of a circuit. The prototypical model is a mechanical device (for example a railroad switch) which can be disconnected from one course and connected to another. See Figure 1.12 for symbol of a switch

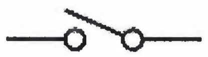


Figure 6.12 Symbol of a Switch

In the simplest case, a switch has two pieces of metal called contacts that touch to make a circuit, and separate to break the circuit. The contact material is chosen for its resistance to corrosion, because most metals form insulating oxides that would prevent the switch from working. Sometimes the contacts are plated with noble metals. They may be designed to wipe against each other to clean off any contamination. Nonmetallic conductors, such as conductive plastic, are sometimes used. The moving part that applies the operating force to the contacts is called the actuator, and may be a toggle or dolly, a rocker, a push-button or any type of mechanical linkage.See Figure 1.13 to for switche buttons used in the circuit.

Figure 6.13 A Button

6.5 Crystals

A crystal is a solid in which the constituent atoms, molecules, or ions are packed in a regularly ordered, repeating pattern extending in all three spatial dimensions.See Figure 1.14 for symbol of a cyristal.and its equivalent circuit.

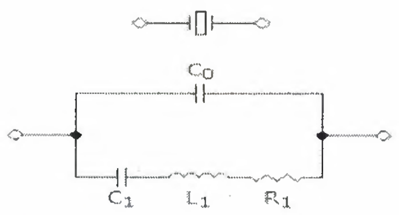


Figure 6.14 Equivalent Circuit of Crystal

Almost any object made of an elastic material could be used like a crystal, with appropriate transducers, since all objects have natural resonant frequencies of vibration. For example, steel is very elastic and has a high speed of sound. It was often used in mechanical filters before quartz. The resonant frequency depends on size, shape, elasticity and the speed of sound in the material. High-frequency crystals are typically cut in the shape of a simple, rectangular plate. Low-frequency crystals, such as those used in digital watches, are typically cut in the shape of a tuning fork.
For applications not needing very precise timing, a low-cost ceramic resonator is often used in place of a quartz crystal. See Figure 6.6

Figure 6.15 A Crystal

When a crystal of quartz is properly cut and mounted, it can be made to bend in an electric field, by applying a voltage to an electrode near or on the crystal. This property is known as piezoelectricity. When the field is removed, the quartz will generate an electric field as it returns to its previous shape, and this can generate a voltage. The result is that a quartz crystal behaves like a circuit composed of an inductor, capacitor and resistor, with a precise resonant frequency. Quartz has the further advantage that its size changes very little with temperature. Therefore, the resonant frequency of the plate, which depends on its size, will not change much, either. This means that a quartz clock, filter or oscillator will remain accurate. For critical applications the quartz oscillator is mounted in a temperature-controlled container, called an crystal oven, and can also be mounted on shock absorbers to prevent perturbation by external mechanical vibrations. Quartz timing crystals are manufactured for frequencies from a few tens of kilohertz to tens of megahertz. More than two billion (2×10^9) crystals are manufactured annually. Most are small devices for wristwatches, clocks, and electronic circuits. However, quartz crystals are also found inside test and measurement equipment, such as counters, signal generators, and oscilloscopes.

6.6. Resistors

A resistor is a standard component that provides resistance in an electrical or electronic circuit. It is available as either a fixed resistor having a specific value in ohms or as a variable resistor with an adjustable range of specified values.

Figure 1.1 shows symbol of a resistor, Figure 1.2 shows a simple resistor.

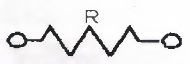


Figure 6.16 Symbol of a Resistor

Figure 6.17 Simple Resistor

Resistors are color coded. To read the color code of a common.Simply 4 band 1K ohm resistor with a 5% tolerance, start at the opposite side of the Gold tolerance band and read from left to right. Write down the corresponding number from Table 6.6

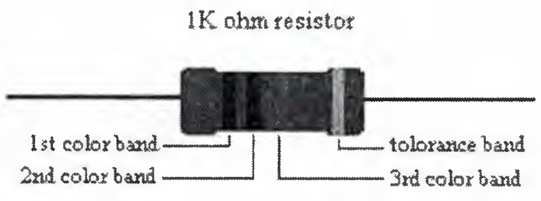


Figure 6.18 A Resistor With Colour Codes

For the 1st color band BROWN. To the right of that number, write the corresponding number for the 2nd band BLACK. Now multiply that number by the corresponding multiplier number of the 3rd band (RED) (100). Your answer will be 1000 or 1K.

Table 6.6 can be used to read the colour codes .

Table 6.6 Colour Codes

Band Color	1st Band #	2nd Band #	*3rd Band #	Multiplier x	Tolerances ± %
Black	0	0	0	1	
Brown	1	1	1	10	± 1%
Red	2	2	2	100	± 2 %
Orange	3	3	3	1000	
Yellow	4	4	4	10,000	
Green	5	5	5	100,000	± 0.5 %
Blue	6	6	6	1,000,000	± 0.25 %
Violet	7	7	7	10,000,000	± 0.10 %
Grey	8	8	8	100,000,000	± 0.05 %
White	9	9	9	1,000,000,000	
Gold				0.1	± 5 %

6.7 AC motors

A typical AC motor consists of two parts:

1. An outside stationary stator having coils supplied with AC current to produce a rotating magnetic field, and;
2. An inside rotor attached to the output shaft that is given a torque by the rotating field.

There are two fundamental types of AC motor depending on the type of rotor used:

- The synchronous motor, which rotates exactly at the supply frequency or a submultiple of the supply frequency, and;
- The induction motor, which turns slightly slower, and typically (though not necessarily always) takes the form of the squirrel cage motor.

The rotating magnetic field principle, though commonly credited to Nikola Tesla in 1882 or thereabouts, was employed by scientists such as Michael Faraday and James Clerk Maxwell in the 1820s. Tesla, however, exploited the principle to design a unique two-phase induction motor in 1883. Michael von Dolivo-Dobrowlsky invented the first modern three-phase "cage-rotor" in 1890. Introduction of the motor from 1888 onwards initiated what is known as the Second Industrial Revolution, making possible the efficient generation and long distance distribution of electrical energy using the alternating current transmission system, also of Tesla's invention (1888). The first successful commercial three phase generation and long distance transmission system was designed by Almerian Decker at Mill Creek No. in Redlands California.

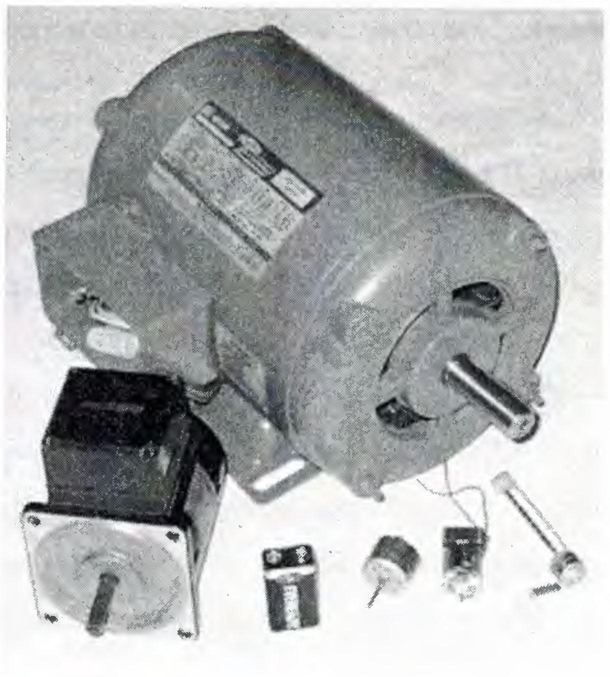


Figure 6.19 Three-phase AC induction motors

Three phase AC induction motors rated 1 Hp (750 W) and 25 W with small motors from CD player, toy and CD/DVD drive reader head traverse

Where a polyphase electrical supply is available, the three-phase (or polyphase) AC induction motor is commonly used, especially for higher-powered motors. The phase differences between the three phases of the polyphase electrical supply create a rotating electromagnetic field in the motor.Through electromagnetic induction, the rotating magnetic field induces a current in the conductors in the rotor, which in turn sets up a counterbalancing magnetic field that causes the rotor to turn in the direction the field is rotating. The rotor must always rotate slower than the rotating magnetic field produced by the polyphase electrical supply; otherwise, no counterbalancing field will be produced in the rotor.Induction motors are the workhorses of industry and motors up to about 500 kW in output are produced in highly standardized frame sizes, making them nearly completely interchangeable between manufacturers (although European and North American standard dimensions are different). Very large synchronous motors are capable of tens of thousands of kW in output, for pipeline compressors and wind-tunnel drives.

There are two types of rotors used in induction motors.

Squirrel Cage rotors: Most common AC motors use the squirrel cage rotor, which will be found in virtually all domestic and light industrial alternating current motors. The squirrel cage takes its name from its shape - a ring at either end of the rotor, with bars connecting the rings running the length of the rotor. It is typically cast aluminum or copper poured between the iron laminates of the rotor, and usually only the end rings will be visible. The vast majority of the rotor currents will flow through the bars rather than the higher-resistance and usually varnished laminates. Very low voltages at very high currents are typical in the bars and end rings; high efficiency motors will often use cast copper in order to reduce the resistance in the rotor.In operation, the squirrel cage motor may be viewed as a transformer with a rotating secondary - when the rotor is not rotating in sync with the magnetic field, large rotor currents are induced; the large rotor currents magnetize the rotor and interact with the stator's magnetic fields to bring the rotor into synchronization with the stator's field. An unloaded squirrel cage motor at synchronous speed will only consume electrical power to maintain rotor speed against friction and resistance losses; as the mechanical load increases, so will the electrical load - the electrical load is inherently related to the mechanical load. This is similar to a transformer, where the primary's electrical load is related to the secondary's electrical load.This is why, as an example, a squirrel cage blower motor may cause the lights in a home to dim as it starts, but doesn't dim the lights when its fanbelt (and therefore mechanical load) is removed. Furthermore, a stalled squirrel cage motor (overloaded or with a jammed shaft) will consume current limited only by circuit resistance as it attempts to start. Unless something else limits the current (or cuts its off completely) overheating and destruction of the winding insulation is the likely outcome.Virtually every washing machine, dishwasher, standalone fan, record player, etc. uses some variant of a squirrel cage motor.

Wound Rotor: An alternate design, called the wound rotor, is used when variable speed is required. In this case, the rotor has the same number of poles as the stator and the windings are made of wire, connected to slip rings on the shaft. Carbon brushes connect the slip rings to an external controller such as a variable resistor that allows changing the motor's slip rate. In certain high-power variable speed wound-rotor drives, the slip-frequency energy is captured, rectified and returned to the power supply through an inverter.Compared to squirrel cage rotors, wound rotor motors are expensive and require maintenance of the slip rings and brushes, but they were the standard form for variable speed control before the advent of compact power electronic devices. Transistorized inverters with variable frequency drive can now be used for speed control and wound rotor motors are becoming less common. (Transistorized inverter drives also allow the more-efficient three-phase motors to be used when only single-phase mains current is available, but this is never used in house hold appliances, because it can cause electrical interference and because of high power requirements.)Several methods of starting a polyphase motor are used. Where the large inrush current and high starting torque can be permitted, the motor can be started across the line, by applying full line voltage to the terminals. Where it is necessary to limit the starting inrush current (where the motor is large compared with the short-circuit capacity of the supply), reduced voltage starting using either series inductors, an autotransformer, thyristors, or other devices are used. A technique sometimes used is star-delta starting, where the motor coils are initially connected in wye for acceleration of the load, then switched to delta when the load is up to speed. This technique is more common in Europe than in North America. Transistorized drives can directly vary the applied voltage as required by the starting characteristics of the motor and load.This type of motor is becoming more common in traction applications such as locomotives, where it is known as the asynchronous traction motor.The speed of the AC motor is determined primarily by the frequency of the AC supply and the number of poles in the stator winding, according to the relation:

$$N_s = 120F / p$$

where

N_s = Synchronous speed, in revolutions per minute

F = AC power frequency

p = Number of poles per phase winding

Actual RPM for an induction motor will be less than this calculated synchronous speed by an amount known as *slip* that increases with the torque produced. With no load the speed will be very close to synchronous. When loaded, standard motors have between

2-3% slip, special motors may have up to 7% slip, and a class of motors known as *torque motors* are rated to operate at 100% slip (0 RPM/full stall).

The slip of the AC motor is calculated by:

$$S = (N_s - Nr) / N_s$$

where

N_r = Rotational speed, in revolutions per minute.

S = Normalised Slip, 0 to 1.

As an example, a typical four-pole motor running on 60 Hz might have a nameplate rating of 1725 RPM at full load, while its calculated speed is 1800.The speed in this type of motor has traditionally been altered by having additional sets of coils or poles in the motor that can be switched on and off to change the speed of magnetic field rotation. However, developments in power electronics mean that the frequency of the power supply can also now be varied to provide a smoother control of the motor speed.

6.7.1 Three-phase AC synchronous motors

If connections to the rotor coils of a three-phase motor are taken out on slip-rings and fed a separate field current to create a continuous magnetic field (or if the rotor consists of a permanent magnet), the result is called a synchronous motor because the rotor will rotate in synchronism with the rotating magnetic field produced by the polyphase electrical supply.A synchronous motor can also be used as an alternator.Nowadays, synchronous motors are frequently driven by transistorized variable frequency drives. This greatly eases the problem of starting the massive rotor of a large synchronous motor. They may also be started as induction motors using a squirrel-cage winding that shares the common rotor: once the motor reaches synchronous speed, no current is induced in the squirrel-cage winding so it has little effect on the synchronous operation of the motor, aside from stabilizing the motor speed on load changes.

Synchronous motors are occasionally used as traction motors; the TGV may be the best-known example of such use.

6.7.2.Single-phase AC induction motors

Three-phase motors inherently produce a rotating magnetic field. However, when only single-phase power is available, the rotating magnetic field must be produced using other means. Several methods are commonly used.A common single-phase motor is the shaded-pole motor, which is used in devices requiring low torque, such as electric fans or other small household appliances. In this motor, small single-turn copper "shading coils" create the moving magnetic field. Part of each pole is encircled by a copper coil or strap; the induced current in the strap opposes the change of flux through the coil (Lenz's Law), so that the maximum field intensity moves across the pole face on each cycle, thus producing the required rotating magnetic field.Another common single-phase AC motor is the *split-phase induction motor*, commonly used in major appliances such as washing machines and clothes dryers. Compared to the shaded pole motor, these motors can generally provide much greater starting torque by using a special startup winding in conjunction with a centrifugal switch.In the split-phase motor, the startup winding is designed with a higher resistance than the running winding. This creates an LR circuit which slightly shifts the phase of the current in the startup winding. When the motor is starting, the startup winding is connected to the power source via a set of spring-loaded contacts pressed upon by the not-yet-rotating centrifugal switch. The starting winding is wound with fewer turns of smaller wire than the main winding, so it has a lower inductance (L) and higher resistance (R). The lower L/R ratio creates a small phase shift, not more than about 30 degrees, between the flux due to the main winding and the flux of the starting winding. The starting direction of rotation may be reversed simply by exchanging the connections of the startup winding reltive to the running winding.The phase of the magnetic field in this startup winding is shifted from the phase of the mains power, allowing the creation of a moving magnetic field which starts the motor. Once the motor reaches near design operating speed, the centrifugal switch activates, opening the contacts and disconnecting the startup winding from the power source. The motor then operates solely on the running winding. The starting winding must be disconnected since it would increase the losses in the motor.In a *capacitor start motor*, a starting capacitor is inserted in series with the startup winding, creating an LC circuit which is capable of a much greater phase shift (and so, a much greater starting torque). The capacitor naturally adds expense to such motors.

Another variation is the *Permanent Split-Capacitor (PSC) motor* (also known as a capacitor start and run motor). This motor operates similarly to the capacitor-start motor described above, but there is no centrifugal starting switch and the second winding is permanently connected to the power source. PSC motors are frequently used in air handlers, fans, and blowers and other cases where a variable speed is desired. By changing taps on the running winding but keeping the load constant, the motor can be made to run at different speeds. Also provided all 6 winding connections are available separately, a 3 phase motor can be converted to a capactor start and run motor by commoning two of the windings and connecting the third via a capacitor to act as a start winding.*Repulsion motors* are wound-rotor single-phase AC motors that are similar to universal motors. In a repulsion motor, the armature brushes are shorted together rather than connected in series with the field. Several types of repulsion motors have been manufactured, but the *repulsion-start induction-run* (RS-IR) motor has been used most frequently. The RS-IR motor has a centrifugal switch that shorts all segments of the commutator so that the motor operates as an induction motor once it has been accelerated to full speed. RS-IR motors have been used to provide high starting torque per ampere under conditions of cold operating temperatures and poor source voltage regulation. Few repulsion motors of any type are sold as of 2006.

6.7.2.1.Single-phase AC synchronous motors

Small single-phase AC motors can also be designed with magnetized rotors (or several variations on that idea). The rotors in these motors do not require any induced current so they do not slip backward against the mains frequency. Instead, they rotate synchronously with the mains frequency. Because of their highly accurate speed, such motors are usually used to power mechanical clocks, audio turntables, and tape drives; formerly they were also much used in accurate timing instruments such as strip-chart recorders or telescope drive mechanisms. The shaded-pole synchronous motor is one version.Because inertia makes it difficult to instantly accelerate the rotor from stopped to synchronous speed, these motors normally require some sort of special feature to get started. Various designs use a small induction motor (which may share the same field coils and rotor as the synchronous motor) or a very light rotor with a one-way mechanism (to ensure that the rotor starts in the "forward" direction).

7. MY PROJECT

7.1. View of my Project

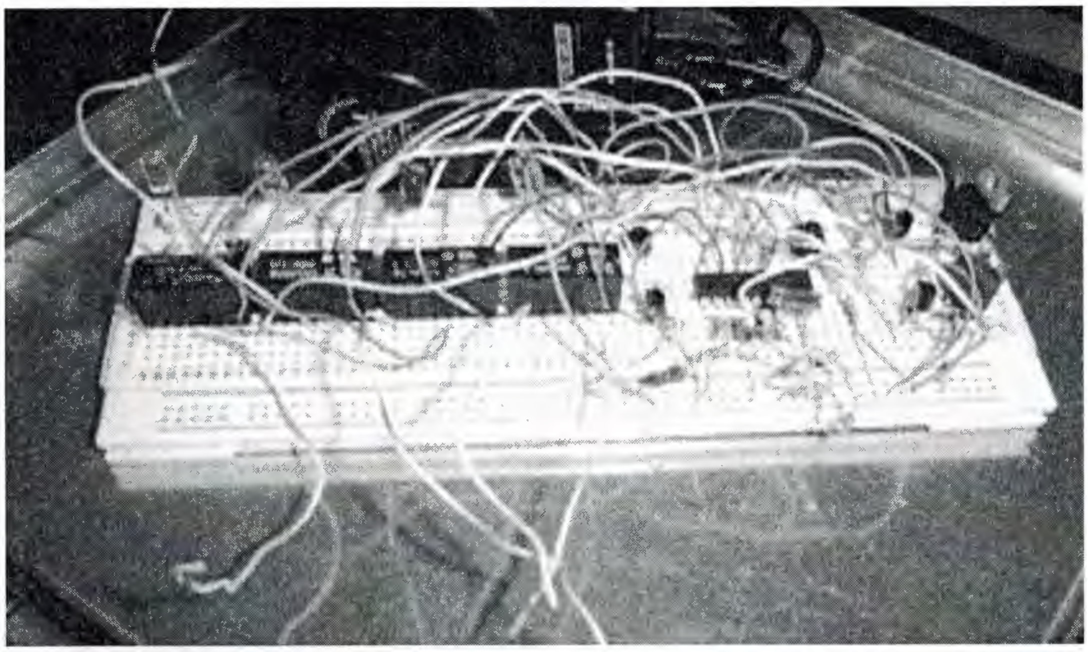


Figure 7.1. My Project

I make my circuit on the board.we can see that I have many wire can not connect yet because these wire will connect the wall panel for control the three pase motor.We see that There are 5 led in here.One of the led is for pic which is small and red one for show to work the pic and the other led also be show the work roles for light.

7.2 Pic Basic pro code and explanation

TRISA=1...................................All of the portA is input

TRISB=0...................................All of the portA is output

PORTA=0.................................All of the portA is 0

PORTB=0.................................All of the portB is 0

TURKIYEM: ....This is the loop

PORTB.4=1...........................PortB4 is logic1 active(led is light so pic is wok)

IF PORTA.2=1 THEN............PortA2 is logic1 active(when press the buton)

HIGH PORTB.0.....................Make PORTB.0 logic 1

PAUSE 30000.........................wait 30sn

LOW PORTB.0...................... Make PORTB.0 logic 0

PAUSE 10000......................... wait 10sn

HIGH PORTB.1..................... Make PORTB.1 logic 1

PAUSE 30000......................... wait 30sn

LOW PORTB.1...................... Make PORTB.1 logic 0

PAUSE 5000........................... wait 5sn

PORTB=$16............................PORTB4,PORTB2,PORTB1 is logic 1

PAUSE 10000

PORTB=$1E..............PORTB4,PORTB3,PORTB2,PORTB1 is logic 1

PAUSE 60000............................wait 60sn

PORTB=$1A...........................PORTB4,PORTB3,PORTB1 is logic 1

PAUSE 15000..........................wait 15sn

PORTB=$18........................... PORTB4,PORTB3 is logic 1

PAUSE 5000............................wait 5sn

```
PORTB=$10............................PORTB4 is logic 1

LOW PORTB.4.........................PORTB4 is logic 1

PAUSE 500...............................wait ½ sn

HIGH PORTB.4.........................PORTB4 is logic 1

PAUSE 500.............................. wait ½ sn

LOW PORTB.4......................... PORTB4 is logic 0

PAUSE 500.............................. wait ½ sn

PORTB.4=1.............................. PORTB4 is logic 1(All the PORTB is logic1)

ENDIF........................(While starting IF PORTA.2=0  end the program)

PAUSE 2.................................wait 2sn

GOTO TURKIYEM:...................( go to wait for again to press PORTA:=1)

END......................................(program is finish)
```

CONCLUSION

Pic is very useful device and also pic is not expensive device so choose this device instead of PLC from some where.PLC is expensive than pic because of this we can do much more thing to low price with use pic.Pic programming is not difficult because of advantage the Pic Basic pro.

Now a day new kind of products develop so engineers should follow these product for backgraunds.Basic Step is also good example.Many websites include different information about it.Basic step is like Picbasic pro but also ıts more easy and has not much more auxiliary device like cristal in the circut.

When connect the system on the wall panel andto take into consideration of connections error and focus on working while use high voltage.

Every step of the programming pic while use Microcod Studio and Ic prog programs errors can be found so that solving the error can learned.

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