

# 5

## PicBasic and PicBasic Pro projects

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In previous chapters we have seen the characteristics of the PIC microcontrollers and how to program these microcontrollers using the PicBasic and PicBasic Pro languages. In this chapter we shall be looking at various PIC microcontroller-based projects. All the projects described here have been constructed and tested using both the PicBasic and PicBasic Pro languages.

Each project has been described with the following sub-headings:

- Project title:** Title of the project
- Project description:** A brief description of the project.
- Hardware:** Hardware used in the project. This is mainly the circuit diagram of the microcontroller and associated interface electronics used for the project.
- Flow diagram:** A flow diagram is given to describe the operation of the project.
- Software:** Listings of the microcontroller programs for both PicBasic and PicBasic Pro languages.

Projects in this chapter have been organised in increasing complexity. It is recommended that the reader study the simple projects first before going to the more complex ones.

## Project 1

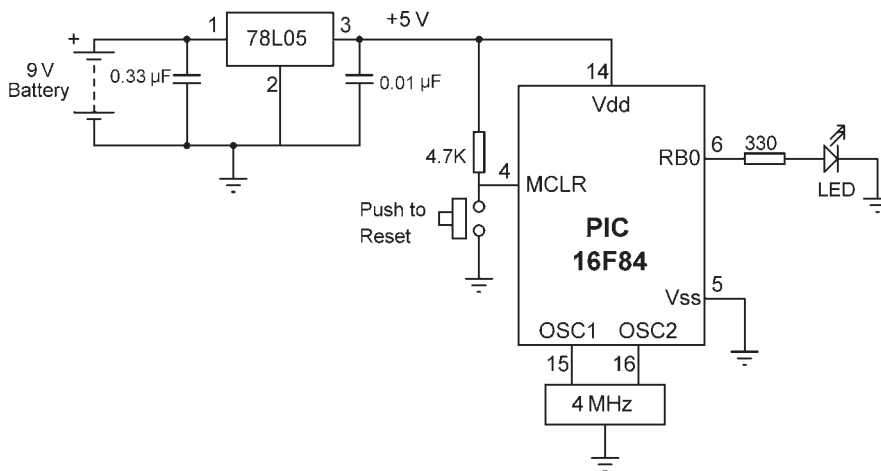
**Project title:** Simple flashing LED

**Project description:** An LED is connected to one of the port pins of a PIC microcontroller. The LED is flashed continuously with 1-s interval.

**Hardware:** This project is so simple that any type of PIC microcontroller can be used. As shown in Figure 5.1, a PIC16F84 type microcontroller is chosen for this project. Bit 0 of PORTB (RB0) is connected to a small LED through a current-limiting resistor. The voltage drop across an LED is approximately 2 V. Assuming an LED current of 10 mA, the value of the resistor can be calculated as

$$R = \frac{V}{I} = \frac{5 - 2}{10 \text{ mA}} = 0.3 \text{ K}$$

the nearest value is 330  $\Omega$ .



**Figure 5.1** Circuit diagram of Project 1

The project has been constructed on a breadboard as shown in Figure 5.2.

**Flow diagram:** The software consists of an indefinite loop where the LED is turned on and off inside this loop. The flow diagram of the software is shown in Figure 5.3.

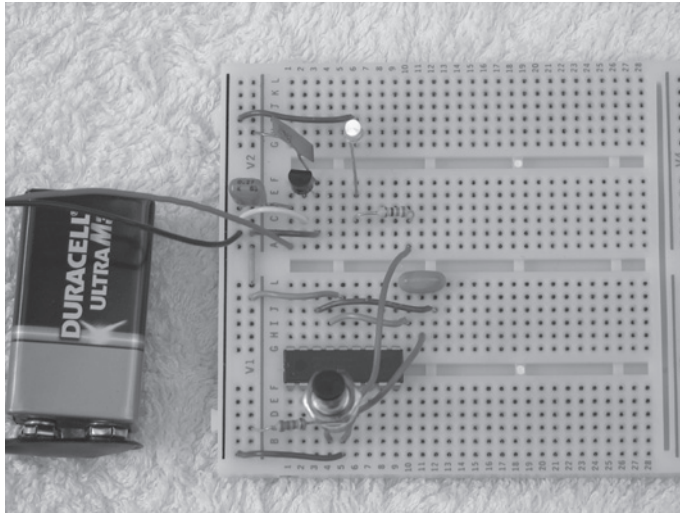


Figure 5.2 Construction of Project 1

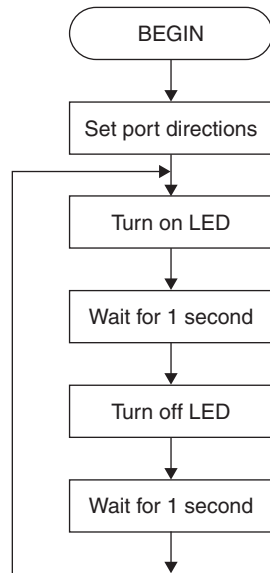


Figure 5.3 Flow diagram of Project 1

**Software: PicBasic**

The software for PicBasic language is shown in Figure 5.4. At the beginning of the program LED is defined as a symbol and is assigned to zero (bit 0 of PORTB). Also, the port direction register TRISB and PORTB

addresses are defined. The main program is an indefinite loop and starts with label AGAIN. Inside the main program the LED is turned on using the HIGH LED instruction. Then after a delay of 1 s (PAUSE 1000) the LED is turned off and this process is repeated forever.

```

*****
'
'           LED FLASHING PROGRAM
'           =====
'
' This program flashes an LED connected to port RB0 of PORTB. The
' Led is flashed with 1 second intervals.
'
' Author:      Dogan Ibrahim
' Date:        October, 2005
' Compiler:    PicBasic
' File:        LED1.BAS
'
' Modifications
' =====
'
*****
'
' SYMBOLS
'
Symbol LED = 0           ' Define RB0 as LED
Symbol TRISB = $86      ' TRISB address
Symbol PORTB = $06     ' PORTB address
'
' START OF MAIN PROGRAM
'
        POKE TRISB, 0    ' Set PORTB pins as outputs

AGAIN:
    HIGH LED            ' Turn ON LED
    PAUSE 1000          ' Wait 1 second

    LOW LED             ' Turn OFF LED
    PAUSE 1000          ' Wait 1 second

    GOTO AGAIN          ' Repeat

    END                 ' End of program

```

**Figure 5.4** PicBasic program of Project 1

**PicBasic Pro**

The software for PicBasic Pro language is shown in Figure 5.5. At the beginning of the program LED is defined as bit 0 of PORTB (PORTB.0). Port direction register TRISB is then cleared so that all PORTB pins are outputs. Main program starts with label AGAIN where the port pin is turned on and off with 1 s intervals.

```

*****
'
'
'           LED FLASHING PROGRAM
'           =====
'
' This program flashes an LED connected to port RB0 of PORTB. The
' LED is flashed with 1 second intervals.
'
' Author:      Dogan Ibrahim
' Date:        October, 2005
' Compiler:    PicBasic Pro
' File:        LED2.BAS
'
' Modifications
' =====
'
*****
'
' DEFINITIONS
'
LED VAR PORTB.0           ' Define RB0 as LED
'
' START OF MAIN PROGRAM
'
'           TRISB = 0           ' Set PORTB pins as outputs
'
AGAIN:
'           LED = 1           ' Turn ON LED
'           PAUSE 1000        ' Wait 1 second
'
'           LED = 0           ' Turn OFF LED
'           PAUSE 1000        ' Wait 1 second
'
'           GOTO AGAIN        ' Repeat
'
'           END               ' End of program

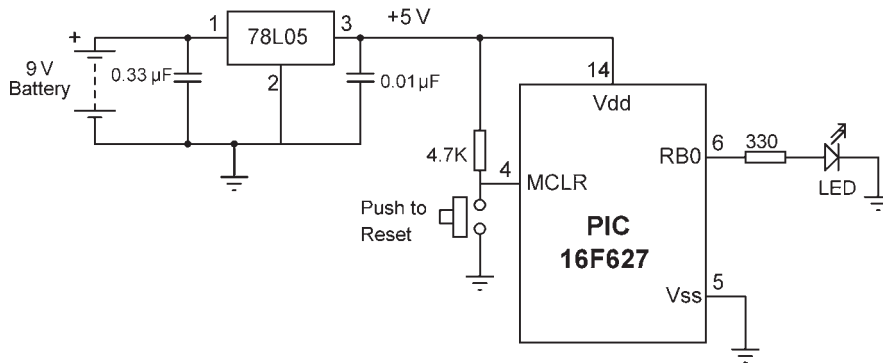
```

**Figure 5.5** PicBasic Pro program of Project 1

### Using a different microcontroller

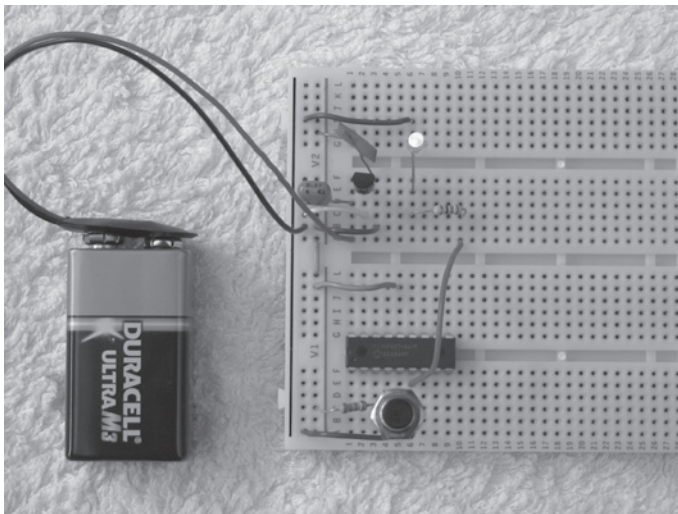
In this project a PIC16F84-type microcontroller has been used. Recently, PIC16F627 has become one of the popular low-cost PIC microcontrollers. This is an 18-pin microcontroller, pin compatible with the PIC16F84, having 16 I/O ports and built-in 4-MHz-clock oscillator. In this section we shall be using the PIC16F627 to flash the LED.

Figure 5.6 shows the circuit diagram of the PIC16F627-based project. The LED is connected to bit 0 of PORTB as in Figure 5.1 and the internal oscillator of the microcontroller is used.



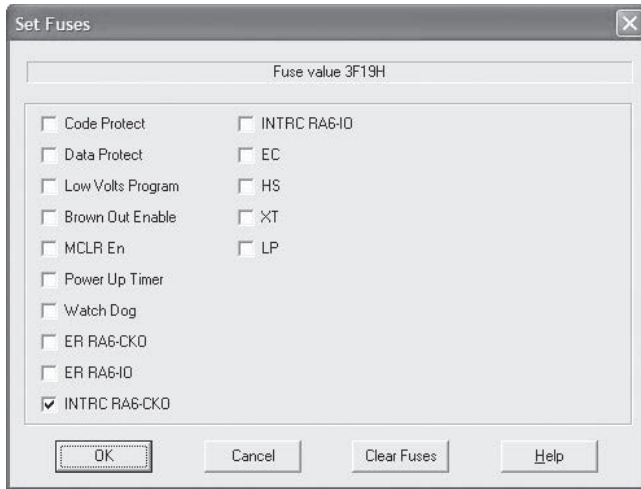
**Figure 5.6** Circuit diagram of the PIC16F627-based project

Figure 5.7 shows the construction of the project on a breadboard. Notice that there are no timing components in this circuit.



**Figure 5.7** Construction of the project on a breadboard

PicBasic and PicBasic Pro programs of the project are same as in Figures 5.4 and 5.5, respectively. The internal 4-MHz-clock oscillator should be selected during programming of the microcontroller as shown in Figure 5.8.



**Figure 5.8** Selecting the internal 4 MHz oscillator during programming

## Project 2

**Project title:** Complex flashing LED

**Project description:** An LED is connected to one of the port pins of a PIC microcontroller. The LED is flashed continuously as in the following sequence:

3 flashes with 250ms interval between each flash.  
2 s delay.  
3 flashes with 250ms interval between each flash.  
.....  
.....

**Hardware:** The hardware of this project is same as in Figure 5.6. A PIC16F627 microcontroller is used in this project with built-in 4 MHz oscillator and an LED is connected to bit 0 of PORTB using a 330  $\Omega$  current-limiting resistor.

**Flow diagram:** The software consists of an indefinite loop where the LED is turned on and off as described in the project description. The flow diagram of the software is shown in Figure 5.9.

**Software:** **PicBasic**  
The software for PicBasic language is shown in Figure 5.10. At the beginning of the program LED is defined as a symbol and is assigned to zero (bit 0 of PORTB). Also, the port-direction register TRISB and PORTB addresses are defined. The main program is an indefinite loop and starts with label AGAIN. Inside the main program a OR loop is formed and the LED is flashed three times with 250 ms intervals. After a 2 s delay the process is repeated. Variable *Cnt* is used as the loop-count variable.

**PicBasic Pro**  
The software for PicBasic Pro language is shown in Figure 5.11. At the beginning of the program port-direction register TRISB is cleared so that all PORTB pins are outputs. Main program starts with label AGAIN. Inside the main program a FOR loop is formed and the LED is flashed three times with 250 ms intervals. After a 2 s delay the process is repeated. Variable *Cnt* is used as the loop-count variable.

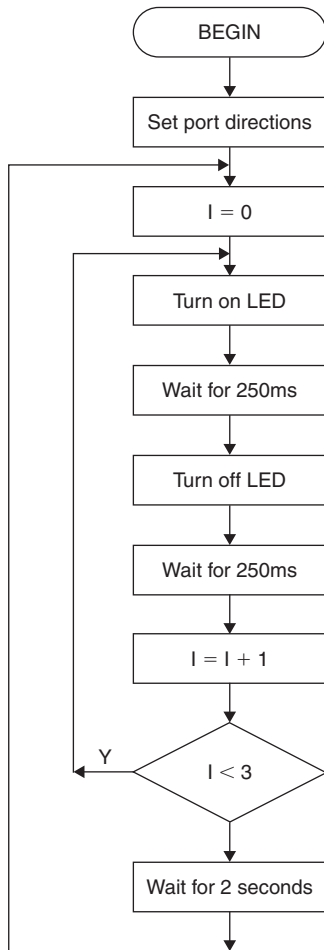


Figure 5.9 Flow diagram of Project 2

```

'*****
'
'          LED FLASHING PROGRAM
'          =====
'
' This program flashes an LED connected to port RB0 of PORTB. The
' LED is flashed continuously as follows:
'
'     Flash 3 times with 250ms intervals
'     Wait 2 seconds
    
```

Figure 5.10 (Continued)

```

'      Flash 3 times with 250ms intervals
'
'      .....
'      .....
'
'
' Author:      Dogan Ibrahim
' Date:       October, 2005
' Compiler:   PicBasic
' File:      LED3.BAS
'
' Modifications
' =====
'
'*****
'
' SYMBOLS
'
Symbol LED = 0           ' Define RB0 as LED
Symbol TRISB = $86      ' TRISB address
Symbol PORTB = $06      ' PORTB address
'
' VARIABLES
'
Symbol Cnt = B0         ' Declare Cnt as a byte
'
' START OF MAIN PROGRAM
'
      POKE TRISB, 0      ' Set PORTB pins as outputs
AGAIN:
      FOR Cnt = 1 TO 3
          HIGH LED      ' Turn ON LED
          PAUSE 250     ' Wait 250ms
          LOW LED       ' Turn OFF LED
          PAUSE 250     ' Wait 250ms
      NEXT Cnt
      PAUSE 2000       ' Wait 2 seconds
      GOTO AGAIN       ' Repeat
      END              ' End of program

```

**Figure 5.10** PicBasic program of Project 2

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