Programming PICS

Commands

There are six standard commands which we use for programming PICS

High This is the command to switch an output on (high).

Low This is the command to switch an output off (low).

Goto This is the command that causes the program flow to "jump" to a new line.

Wait This is the command that causes a pause in units of 0.1 seconds. For example to create a pause 1 second long the command would be wait 010.

Out This is the command to switch all the outputs either high or low simultaneously. The binary value (0-255) is transferred to the output pins.

Beep This is the command that generates a sound. The "pitch" of the sound is given by the value. The higher the value the higher the frequency.

Where to start

Before trying to write programs it is a good idea to produce a flow chart or diagram setting out each stage of what you want to happen.

Example Write a program to make an LED flash on and off at 1 second intervals

Switch LED on
Pause for 1 second
Switch LED off
Pause for 1 second
Go back to the beginning

To write the actual program each line will begin with a two digit number in sequence. The first line will begin 00. As you want to switch the LED on, the command is **high**. As the PIC has more than one output you have to specify which output to switch on. In this case it is output one. So the first line of the program will be

```
00      high    1
```

The next stage of the flow diagram is to make the LED stay on for 1 second. The next line of the program will be

```
01      wait    010
```

The third stage of the flow diagram is to make the LED switch off. The program will read

02 low 1

The fourth stage of the flow diagram is to pause for 1 second. So the line will read

03 wait 010

The final stage of the flow diagram is to go back to the beginning. The last line will read

04 goto 00

The full program will be

00 high 1
01 wait 010
02 low 1
03 wait 010
04 goto 00

Exercise 1

Begin each answer with a flow diagram.

1.Write a program to make an LED flash on and off every 2 seconds?
2. Write a program to make an LED flash on and off every ½ second?

The example program will perform the same function as the Astable circuit you constructed earlier. The big advantage of the PIC over the 555 circuit is that to change the on and off period with the PIC you only have to change two lines of the program. With the 555 circuit you would have to desolder two resistors and replace them with different value resistors. The main disadvantage of a PIC in this example is that it costs £1.99 against £0.12 for the 555.

However for more complex requirements a PIC offers a number of advantages including a reduction in the number of external components. This introduces both cost and space benefits.

Using the Chip Factory software write your program so that you can see if it works. The full program for the example is shown on the next page. To enter the correct command in the column headed main, double click in the box relating to that line. Then select the correct command.

	If	Cond	Value	Main	Value
00				high	1
01				wait	010
02				low	1
03				wait	010
04				goto	00
05					

One of the advantages of using PICs is that there is more than one output connection. In the next exercise you will meet a new command, the OUT command.

As you already know in digital electronics, we refer to high states and low states. These are represented by the number 1 for high and 0 for low. We also use binary numbers to represent deanery numbers. For example the number 10 is represented in binary as

Chip Factory output	4	3	2	1	0
Deanery value	16	8	4	2	1
Binary value	0	1	0	1	0

This can be seen as follows 10 = (1 x 8) + (0 x 0) + (1 x 2) + (0 x 1)

If each of the numbers 1, 2, 4, 8, 16 and 32 were represented by LED's, the LED's representing 8 and 2 would light. These are light outputs 1 and 3.

The command we use is OUT and then we specify the deanery value.

Exercise 2

You have been asked by a disco lighting manufacturer to write a simple program to sequence four lights. There needs to be a pause of 1 second between each light. Begin by producing a flow chart and then write your program using the OUT, WAIT and GOTO commands. Save your program as seq1

Exercise 3

The disco lighting manufacturer has asked that after the sequence is completed, all the lights come on for 1 second and then the sequence begins all over again. Modify your program and save your program as seq2

Exercise 4

You have been asked by a road traffic department to write a simple program to operate a traffic light. The red light is to be on for 10 seconds and the green is to be on for 5 seconds. Begin by producing a flow diagram and then write your program. Save your program as traffic1.

Beep command

With many of the electronic products we use today, when you press the keys on the keypad they produce a beep. Examples include a bank cash point and a telephone.

PIC's can be programmed to produce a beep. The beep command is followed by a number (0 to 255) Each number corresponds to a different pitch frequency. The higher the number the higher the pitch.

Exercise 5

You have been asked by a door alarm manufacturer to write a simple program to generate a musical tune once a door has been opened. The tune is to have a maximum of ten notes. The notes can be repeated.

The IF statement

The IF statement involves a "condition" that must be true for the main command within the statement to be completed. The different types of IF statement are:

Involving the digital inputs
e.g.

if input 0 is off then…	if 0 off	(off = low)
if input 1 is on then…	if 1 on	(on = high)

Involving variables
e.g.

if variable x = 8 then…	if x = 008	(equals)
if variable y > 35 then…	if y>035	(greater than)
if variable x < y then…	if x< y	(less than)
if variable x != 0 then…	if x!000	(not equal to)

Example

```
00      if 0 off low 0 ‘ If input off switch output off
01      if 0 on high 0 ‘ If input on switch output on
02      if 1 off low 1 ‘ If input off switch output off
03      if 1 on high 1 ‘If input on switch output on
04              goto 00 ‘Loop back to line 00
```