9
The 16C54 microcontroller

The 16C54 is an example of a one time programmable (OTP) device.

The 16C54 device was brought out before the 16F84.

The main difference between them is that the 16C54 is not electrically erasable, it has to be erased by UV light for about 15 minutes.

The 16C54 JW version is UV erasable.

The 16C54LP is a one time (only) programmable (OTP), 32 kHz version.

You would use a 16C54 JW for development and then program a OTP device for your final circuit. The OTP device has to be selected for the correct oscillator i.e. LP for 32kHz crystal, XT for 4MHz, HS for 20MHz and R-C for an R-C network.

The header for use with the 16C54 is shown below.

Header for the 16C54

```
; HEADER54.ASM for 16C54. This sets PORTA as an INPUT (NB 1
;                               means input) and PORTB as an OUTPUT
;                               (NB 0 means output). The OPTION
;                               register is set to /256 to give timing pulses
;                               of 1/32 of a second.
;                               1 second and 0.5 second delays are
;                               included in the subroutine section.
;***************************************************************
; EQUATES SECTION

TMR0          EQU    1        ;means TMR0 is file 1.
STATUS        EQU    3        ;means STATUS is file 3.
PORTA         EQU    5        ;means PORTA is file 5.
PORTB         EQU    6        ;means PORTB is file 6.
ZEROBIT       EQU    2        ;means ZEROBIT is bit 2.
COUNT         EQU    7        ;means COUNT is file 7,
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                              ;a register to count events
TIME            EQU    8      ;file8 where the time is stored.
;****************************************************************

LIST            P=16C54       ; we are using the 16C54.
ORG             01FFH         ;the start address in memory is 1FF at the
                              ;end.
GOTO            START         ; goto start!
ORG             0
;****************************************************************

;SUBROUTINE SECTION.

; 1 second delay.
DELAY1    CLRF      TMR0                    ;START TMR0.
LOOPA     MOVLW     .32
          MOVWF     TIME                    ;Time = 32/32 secs.
          MOVF      TMR0,W                  ;Read TMR0 into W.
          SUBWF     TIME,W                  ;TIME - 32, result in W.
          BTFSS     STATUS,ZEROBIT          ;Check TIME-W = 0
          GOTO      LOOPA                   ;Time is not = 32.
          RETLW     0                       ;Time is 32, return.

; 0.5 second delay.

DELAYP5   CLRF      TMR0                    ;START TMR0.
LOOPB     MOVLW     .16
          MOVWF     TIME                    ;Time = 16/32 secs.
          MOVF      TMR0,W                  ;READ TMR0 INTO W.
          SUBWF     TIME,W                  ;TIME - 16
          BTFSS     STATUS,ZEROBIT          ;Check TIME-W = 0
          GOTO      LOOPB                   ;Time is not = 16.
          RETLW     0                       ;Time is 16, return.
;****************************************************************

;CONFIGURATION SECTION

START        MOVLW        B'00001111'    ;4 bits of PORTA are I/P
             TRIS         PORTA
             MOVLW        B'00000000'
             TRIS         PORTB          ;PORTB is OUTPUT
             MOVLW        B'00000111'    ;Prescaler is /256
```

```
          OPTION                        ;TIMER is 1/32 secs.
          CLRF          PORTA          ;Clears PortA.
          CLRF          PORTB          ;Clears PortB.
;****************************************************************
;
;Program starts now.
```

This header can now be used to write programs for the 16C54 Microcontroller.

There are a number of differences between the 16F84 and the 16C54 that the header has taken care of, but be aware of the differences when writing your program.

- The 16C54 does not use Banks so there is no need to change from one to the other.
- There are only 7 Registers on the 16C54 (see 16C54 Memory Map Table 9.1). So the user files start at number 7. i.e. COUNT EQU 7, TIME EQU 8.
- The 16C54 does not have the instruction SUBLW. So in the DELAY subroutine the delay is moved into a file called TIME. (NB. TIME EQUATES TO 8) Then the delay in the file is subtracted from W, giving the same result as for the 16F84.
- Why bother using the 16C54? The reprogrammable 16C54 i.e. 16C54JW is more expensive than the 16F84. But the one time programmable (OTP) 16C54 i.e. 16C54/04P is cheaper. So when your design is final you can blow the program into the cheaper 16C54/04P. Why bother with the expensive 16C54JW and not the 16F84 for program development? I don't know! Only convenience – not having to change the program.
- The 16C54JW has to be erased under an ultra violet lamp for about 15 minutes – this is a bind if you are impatient, you may need a couple.
- Pin 3 is only a T0CKI pin it does not double as A4 like the 16F84 and must be pulled high if the T0CKI is not being used.

16C54 memory map

Table 9.1 16C54 memory map

FILE ADDRESS	FILENAME
00	INDIRECT ADDRESS
01	TMR0
02	PC
03	STATUS
04	FSR
05	PORTA
06	PORTB
07	USER FILE
08	USER FILE
09	USER FILE
0A	USER FILE
0B	USER FILE
0C	USER FILE
0D	USER FILE
0E	USER FILE
0F	USER FILE
10	USER FILE
11	USER FILE
12	USER FILE
13	USER FILE
14	USER FILE
15	USER FILE
16	USER FILE
17	USER FILE
18	USER FILE
19	USER FILE
1A	USER FILE
1B	USER FILE
1C	USER FILE
1D	USER FILE
1E	USER FILE
1F	USER FILE