
Software Stack Management

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INTRODUCTION

The PIC16C5X has a stack which is only 2 deep, and, as a result, only two nested calls can be made (i.e., only one call within a call routine). If more than two levels of subroutine nesting is required, this application note can be used to implement a stack manager to handle the flow of the calls.

Note: Since the amount of RAM on the PIC16C5X is limited, it would be prudent to determine the maximum number of nested calls which have to be made in a program and define the stack length appropriately.

IMPLEMENTATION

This application note implements a 5-deep stack, so 5 nested calls can be made without overflowing the stack. `NCALL` is defined as a MACRO which will be used instead of the mnemonic `CALL`, when a subroutine call is made. The `NCALL` routine, "pushes" the return PC value on the "stack" and then executes the called subroutine. At the end of the subroutine, instead of using the `RETLW k` instruction, a `GOTO RETURN` is executed, where `RETURN` is a routine which "pops" the return PC value from the "stack" and resumes the normal flow of the program.

Note: Since Software Stack Management utilizes the FSR register, and indirect addressing, the user should restore the "original" values to the FSR register if it is used elsewhere in the program.

The routines, as described in this application note, will work only if the called routine is within the first 256 words for each program. If the user desires to branch over to the other low 256-byte program pages, as in the PIC16C57, then the status byte should be saved along with the PC.

Please check the Microchip BBS for the latest version of the source code. Microchip's Worldwide Web Address: www.microchip.com; Bulletin Board Support: MCHIPBBS using CompuServe® (CompuServe membership not required).

APPENDIX A: SOFTWARE STACK MANAGEMENT SAMPLE PROGRAM

MPASM 01.40 Released

SM.ASM 1-16-1997 13:03:22

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```

LOC  OBJECT CODE      LINE SOURCE TEXT
VALUE
                                00001      LIST      P = 16C54, n = 66
                                00002      ;
                                00003      ;*****
                                00004      ;      sm.asm:
                                00005      ;      Routine, demonstrating how to implement a stack
                                00006      ;      manager capable of handling more than 2
                                00007      ;      subsequent subroutine calls.
                                00008      ;      Note: Since this is a demo, NOP has been used
                                00009      ;      where normally the body of the subroutine would
                                00010      ;      reside.
                                00011      ;
                                00012      ;      Program:          SM.ASM
                                00013      ;      Revision Date:
                                00014      ;                  1-13-97      Compatibility with MPASMWIN 1.40
                                00015      ;
                                00016      ;*****
                                00017      ;
                                00018      ;
00000002      00019  PC      EQU      2
00000004      00020  FSR    EQU      4
                                00021      ;
00000001      00022  F      EQU      1
                                00023      ;
0008          00024          ORG      8
0008          00025  STACK  RES      5      ;define stack size = 5
                                00026      ;
01FF          00027          ORG      01FF
01FF 0A07     00028          GOTO    START
                                00029      ;
0000          00030          ORG      0
                                00031      ;
0000 0C08     00032  INIT    MOVLW   STACK ;load "stack" as indirect pointer
0001 0024     00033          MOVWF   FSR    ;      /
0002 0A07     00034          GOTO    START ;      /
                                00035      ;
                                00036      ;*****
                                00037      ;define NCALL as a MACRO used instead of the
                                00038      ;mnemonic CALL.
                                00039      ;
                                00040  NCALL  MACRO  LABEL
                                00041          MOVF   PC,W    ;save PC on "stack"
                                00042          MOVWF  0      ;      /
                                00043          INCF   FSR, F ;Inc. "stack" pointer.
                                00044          GOTO   LABEL ;jump to routine
                                00045          ENDM
                                00046      ;
                                00047      ;return from subroutine NCALL
                                00048      ;
0003 00E4     00049  RTN    DECF    FSR, F ;point to last "stack" location
0004 0C03     00050          MOVLW   3      ;add 3 and output value from FSR
0005 01C0     00051          ADDWF   0,W    ;      /
0006 0022     00052          MOVWF   PC    ;load in PC as next executable
                                00053          ;instruction
                                00054      ;

```

```

00055 ;*****
00056 ;
00057 PAGE
00058 ;
0007 0000 00059 START NOP
00060 NCALL TOM
0008 0202 M MOVF PC,W ;save PC on "stack"
0009 0020 M MOVWF 0 ; /
000A 02A4 M INCF FSR, F ;Inc. "stack" pointer.
000B 0A0F M GOTO TOM ;jump to routine
000C 0000 00061 NOP ;body of main routine
000D 0000 00062 NOP ; /
000E 0003 00063 SLEEP
00064 ;
000F 0000 00065 TOM NOP
00066 NCALL DICK
0010 0202 M MOVF PC,W ;save PC on "stack"
0011 0020 M MOVWF 0 ; /
0012 02A4 M INCF FSR, F ;Inc. "stack" pointer.
0013 0A16 M GOTO DICK ;jump to routine
0014 0000 00067 NOP ;body of routine TOM
0015 0A03 00068 GOTO RTN
00069 ;
0016 0000 00070 DICK NOP
00071 NCALL HARRY
0017 0202 M MOVF PC,W ;save PC on "stack"
0018 0020 M MOVWF 0 ; /
0019 02A4 M INCF FSR, F ;Inc. "stack" pointer.
001A 0A1D M GOTO HARRY ;jump to routine
001B 0000 00072 NOP ;body of routine DICK
001C 0A03 00073 GOTO RTN
00074 ;
001D 0000 00075 HARRY NOP ;body of routine HARRY
001E 0000 00076 NOP ; /
001F 0A03 00077 GOTO RTN
00078 ;
00079 ;
00080 END

```

MEMORY USAGE MAP ('X' = Used, '-' = Unused)

```

0000 : XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXX -----
01C0 : -----X

```

All other memory blocks unused.

```

Program Memory Words Used: 33
Program Memory Words Free: 479

```

```

Errors : 0
Warnings : 0 reported, 0 suppressed
Messages : 0 reported, 0 suppressed

```

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