AN548

Implementing Table Read and Table Write

Author: *Stan D'Souza*
Microchip Technology Inc.

INTRODUCTION

This application note discusses how to retrieve data from program memory to data memory and write data from data memory to program memory.

RETLW K Instruction

As in all PIC17CXXX family parts, the simplest method used to retrieve data from program memory to data memory is to use the RETLW K instruction. For example:

```
; simple program to transfer
; table values to PortB
Main
        movlw   5,W         ;load offset
        call    SimpleTableRead
        movwf   PortB       ;output to PortB
        •
        •
        •
SimpleTableRead
        addwf   PC          ;add offset to PC
Table   retlw   0           ;return a known
                            ;table value based
                            ;on the OFFSET.
        •
        •
        •
        retlw   10
```

In the example above, OFFSET is loaded with the required offset to the Table and the subroutine SimpleTableRead is called. The table value is returned in the W register. In this manner program memory can be transferred to data memory.

Table Read Instruction

The PIC17C42 has an expanded instruction set which includes the TABLRD and TLRD instructions. These instructions are specifically constructed to transfer data from program memory to data memory.

If the instruction syntax is: TABLRD t,i,f, the sequence in which this instruction is executed is as follows:

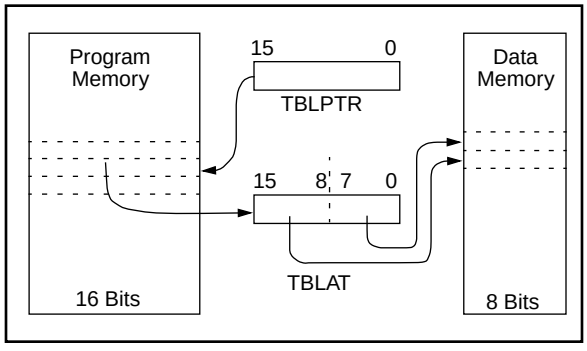
a) if t = 1 then the high byte of the table latch (TBLATH) is loaded in the file register f.
b) else (if t = 0) the low byte of the table latch (TBLATL) is loaded in the file register f.
c) next, the 16 bit data pointed to by the table pointer (TBLPTR) is loaded into the table latch.
d) lastly, if i = 1 the table pointer (TBLPTR) is incremented.

Note: The first time this instruction is executed in a sequence, the table latch will not be initialized, hence an unknown value will be loaded in the file register. This is not a problem if the user overwrites the same f register in the next subsequent instruction.

If the instruction syntax is: TLRD t,f, the sequence in which this instruction is executed is as follows:

a) if t = 1 then the high byte of the table latch (TBLATH) is loaded in the file register f.
b) else (if t = 0) the low byte of the table latch (TBLATH) is loaded in the file register f.

FIGURE 1: TABLE READ



Read In-Line

A simple method of transferring data from program memory to data memory is to use the TABLRD and TLRD instructions in sequence as shown in the example below:

```
;transfer 6 bytes of data from program memory
;at 0x500, to data memory at 0x80

ReadInLine
   movlw   05        ;load table pointer
                     ; with 0x500
   movwf   TBLPTRH   ;      /
   clrf    TBLPTRL   ;      /
   tablrd  0,1,0x80  ;get 16 bit value in
                     ;table latch.
   tlrd    0,0x80    ;low byte (1st) @ 80
   tablrd  1,1,0x81  ;high byte (2nd) @ 81
   tlrd    0,0x82    ;3rd byte @ 82
   tablrd  1,1,0x83  ;4th byte @ 83
   tlrd    0,0x84    ;5th byte @ 84
   tablrd  1,1,0x85  ;6th byte @ 85
```

Reading a Block of Data

In instances where a block of N bytes needs to be transferred from program memory to data memory, the TABLRD and TLRD instruction need to be included in a loop which checks for N transfers.

```
;transfer 'COUNT' bytes (even values only) of
;data at program memory 'MESSAGE' to data
;memory at: 'RAM_BUFFER'
ReadBlock
   movlw   high MESSAGE   ;load table pointer
   movpf   W,TBLPTRH      ;      /
   movlw   low MESSAGE    ;      /
   movpf   W,TBLPTRL      ;      /
   bcf     ALUSTA,5       ;enable post auto
                          ;increment of FSR0
   movlw   RAM_BUFFER     ;initialize FSR0
                          ;to RAM_BUFFER
   movfp   W,FSR0         ;        /
   movlw   COUNT/2        ;initialize count
   tablrd  1,1,RAM_BUFFER ;initialize table
                          ;latch
ReadBlockLoop
   tlrd    1,0x00         ;do indirect read
                          ;of high byte
   tablrd  0,1,0x00       ;do indirect read
                          ;of low byte
   decfsz  W              ;check if count=0
   goto    ReadBlockLoop  ;no then do next
   return                 ;else end of
                          ;transfer.
```

Program	Code Size	Transfer Rate
Simple Table Read (using RETLW)	N + 3	6 cycles/byte
Read In-Line	4 + N + N/2	1.5 cycles/byte
Read Block (using loop)	14 + N/2	3 cycles/byte

N = Number of bytes to transfer

	Code Size		
	Simple Table Read	Read In-Line	Read Block
N = 10	13	19	19
N = 20	23	34	24

Conclusion:

In cases where the number of bytes to be transferred is small, the Read In-Line offers small code size for fast transfer rate. However, as the number of bytes to be transferred increases, the Read Block offers optimum code size for a decent transfer rate.

Table Write Instruction

The PIC17C42 has a TABLWT and a TLWT instruction which transfer data from data memory to program memory. Note in cases where the table pointer points to internal EPROM, the table write instruction will try to program the EPROM, hence the programming voltage must be present on the VPP line to successfully program the part.

The instruction syntax is: `TABLWT t,i,f`.

The sequence in which this instruction is executed is as follows:

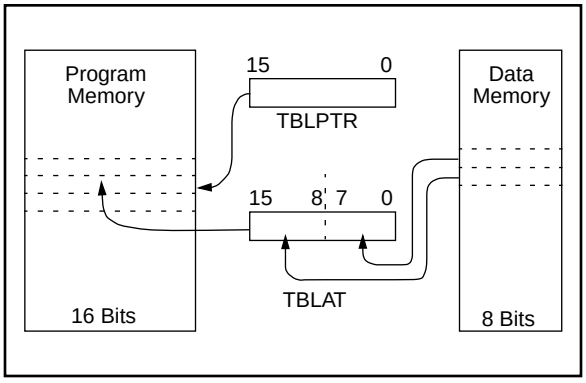
a) if t = 1 then the file register f is loaded to the high byte of the table latch (TBLATH).
b) else (if t = 0) the file register f is loaded to the low byte of the table latch (TBLATL).
c) next, the 16-bit data in the table latch is transferred to the program memory pointed to by the table pointer (TBLPTR).
d) lastly, if i = 1 the table pointer (TBLPTR) is incremented.

The instruction syntax is: `TLWT t,f`

The sequence in which this instruction is executed is as follows:

a) if t = 1 then the file register f is loaded to the high byte of the table latch (TBLATH).
b) else (if t = 0) the file register f is loaded to the low byte of the table latch (TBLATL).

FIGURE 2: TABLE WRITE



Write In-Line

A simple method of transferring data from data memory to program memory is to use the TABLWT and TLWT instruction in sequence as shown in the example below:

```
;transfer 6 bytes of data in data memory at
;0x80, to program memory at 0x5000:
ReadInLine
   movlw   50        ;load table pointer
                     ;with 0x5000
   movwf   TBLPTRH   ;      /
   clrf    TBLPTRL   ;      /
   tlwt    1,0x80    ;high byte @ table latch.
   tablwt  0,1,0x81  ;low byte @ table latch
                     ;latch  @ prog. mem.
   tlwt    1,0x82    ;3rd and 4th byte
                     ;@ prog. mem.
   tablwt  0,1,0x83  ;      /
   tlwt    1,0x84    ;5th and 6th byte
                     ;@ prog. mem.
   tablwt  0,1,0x85  ;      /
```

Writing a Block of Data

In instances where a block of N bytes needs to be transferred from data memory to program memory, the `tablwt` and `tlwt` instructions need to be included in a loop which checks for N transfers.

```
;transfer 'COUNT' bytes (even values only) of
;data at program memory at 'RAM_BUFFER' to
;program memory at 'MESSAGE'
WriteBlock
   movlw   high MESSAGE   ;load table pointer
   movpf   W,TBLPTRH      ;      /
   movlw   low MESSAGE    ;      /
   movpf   W,TBLPTRL      ;      /
   bcf     ALUSTA,5       ;enable post auto
                          ;increment of FSR0
   movlw   RAM_BUFFER     ;initialize FSR0
                          ;to RAM_BUFFER
   movfp   W,FSR0         ;        /
   movlw   COUNT/2        ;initialize count
WriteBlockLoop
   tlwt    1,0x00         ;high byte
                          ;@ table latch
   tablwt  0,1,0x00       ;low byte @ table
                          ;latch;
                          ;table latch
                          ;@ prog. mem.
   decfsz  W              ;check if count = 0
   goto    WriteBlockLoop ;no then do next
   return                 ;else end of transfer
```

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2355 West Chandler Blvd.
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Web Address: http://www.microchip.com

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Kokomo, Indiana 46902
Tel: 765-864-8360 Fax: 765-864-8387

Los Angeles
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Irvine, CA 92612
Tel: 949-263-1888 Fax: 949-263-1338

New York
150 Motor Parkway, Suite 202
Hauppauge, NY 11788
Tel: 631-273-5305 Fax: 631-273-5335

San Jose
Microchip Technology Inc.
2107 North First Street, Suite 590
San Jose, CA 95131
Tel: 408-436-7950 Fax: 408-436-7955

Toronto
6285 Northam Drive, Suite 108
Mississauga, Ontario L4V 1X5, Canada
Tel: 905-673-0699 Fax: 905-673-6509

ASIA/PACIFIC

Australia
Microchip Technology Australia Pty Ltd
Suite 22, 41 Rawson Street
Epping 2121, NSW
Australia
Tel: 61-2-9868-6733 Fax: 61-2-9868-6755

China - Beijing
Microchip Technology Consulting (Shanghai) Co., Ltd., Beijing Liaison Office
Unit 915
Bei Hai Wan Tai Bldg.
No. 6 Chaoyangmen Beidajie
Beijing, 100027, No. China
Tel: 86-10-85282100 Fax: 86-10-85282104

China - Chengdu
Microchip Technology Consulting (Shanghai) Co., Ltd., Chengdu Liaison Office
Rm. 2401, 24th Floor,
Ming Xing Financial Tower
No. 88 TIDU Street
Chengdu 610016, China
Tel: 86-28-6766200 Fax: 86-28-6766599

China - Fuzhou
Microchip Technology Consulting (Shanghai) Co., Ltd., Fuzhou Liaison Office
Unit 28F, World Trade Plaza
No. 71 Wusi Road
Fuzhou 350001, China
Tel: 86-591-7503506 Fax: 86-591-7503521

China - Shanghai
Microchip Technology Consulting (Shanghai) Co., Ltd.
Room 701, Bldg. B
Far East International Plaza
No. 317 Xian Xia Road
Shanghai, 200051
Tel: 86-21-6275-5700 Fax: 86-21-6275-5060

China - Shenzhen
Microchip Technology Consulting (Shanghai) Co., Ltd., Shenzhen Liaison Office
Rm. 1315, 13/F, Shenzhen Kerry Centre,
Renminnan Lu
Shenzhen 518001, China
Tel: 86-755-2350361 Fax: 86-755-2366086

Hong Kong
Microchip Technology Hongkong Ltd.
Unit 901-6, Tower 2, Metroplaza
223 Hing Fong Road
Kwai Fong, N.T., Hong Kong
Tel: 852-2401-1200 Fax: 852-2401-3431

India
Microchip Technology Inc.
India Liaison Office
Divyasree Chambers
1 Floor, Wing A (A3/A4)
No. 11, O'Shaugnessey Road
Bangalore, 560 025, India
Tel: 91-80-2290061 Fax: 91-80-2290062

Japan
Microchip Technology Japan K.K.
Benex S-1 6F
3-18-20, Shinyokohama
Kohoku-Ku, Yokohama-shi
Kanagawa, 222-0033, Japan
Tel: 81-45-471- 6166 Fax: 81-45-471-6122

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Microchip Technology Korea
168-1, Youngbo Bldg. 3 Floor
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Microchip Technology Singapore Pte Ltd.
200 Middle Road
#07-02 Prime Centre
Singapore, 188980
Tel: 65-334-8870 Fax: 65-334-8850

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Microchip Technology Taiwan
11F-3, No. 207
Tung Hua North Road
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Microchip Technology Nordic ApS
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Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79

Germany
Microchip Technology GmbH
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Italy
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20041 Agrate Brianza
Milan, Italy
Tel: 39-039-65791-1 Fax: 39-039-6899883

United Kingdom
Arizona Microchip Technology Ltd.
505 Eskdale Road
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Wokingham
Berkshire, England RG41 5TU
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