

Implementing Table Read and Table Write

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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:

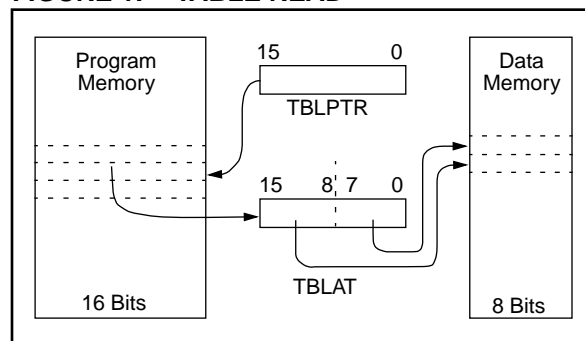
- if t = 1 then the high byte of the table latch (TBLATH) is loaded in the file register f.
- else (if t = 0) the low byte of the table latch (TBLATL) is loaded in the file register f.
- next, the 16 bit data pointed to by the table pointer (TBLPTR) is loaded into the table latch.
- lastly, if i = 1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

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

FIGURE 1: TABLE READ



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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:

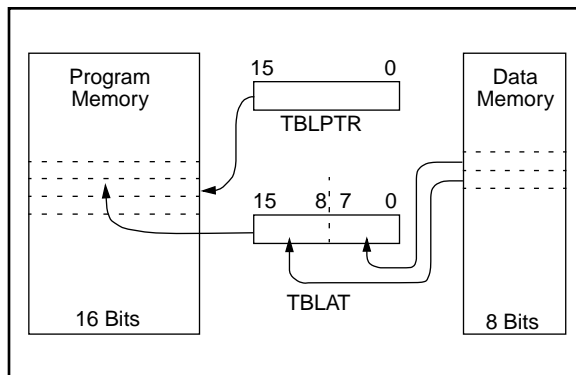
- if `t = 1` then the file register `f` is loaded to the high byte of the table latch (`TBLATH`).
- else (if `t = 0`) the file register `f` is loaded to the low byte of the table latch (`TBLATL`).
- next, the 16-bit data in the table latch is transferred to the program memory pointed to by the table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

- if `t = 1` then the file register `f` is loaded to the high byte of the table latch (`TBLATH`).
- 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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