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7544 Group

Timer X Operation (Event Counter Mode)

1. Abstract

The following article introduces and shows an application example of event counter mode of timer X.

2. Introduction

The explanation of this issue is applied to the following condition:

Applicable MCU: 7544 Group

3. Contents

Outline: Pulses generated corresponding to the water flow rate are counted for a fixed period (100 ms), and the water flow rate during this period is calculated.

Specifications: Pulses generated corresponding to the water flow rate are input to the P14/CNTR₀ pin and counted using timer X.

The contents of timer X are read in the timer A interrupt processing routine generated after 100 ms from the start of counting pulses, and the water flow rate during 100 ms is calculated.

Operation clock: $f(X_{IN}) = 8 \text{ MHz}$, high-speed mode

3.1 Example of Peripheral Circuit

Figure 1 shows an example of a peripheral circuit.

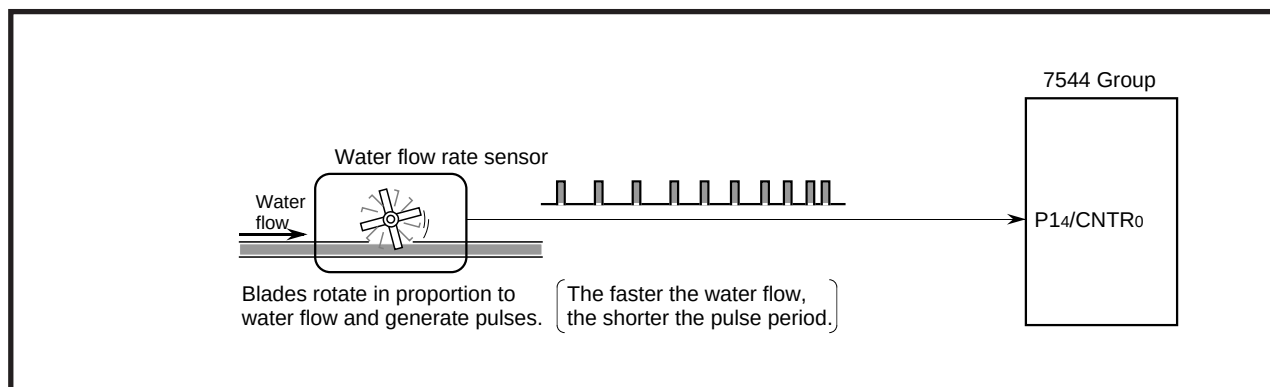


Figure 1 Example of peripheral circuit

3.2 Method of Measuring Water Flow Rate

Figure 2 shows the method of measuring water flow rate.

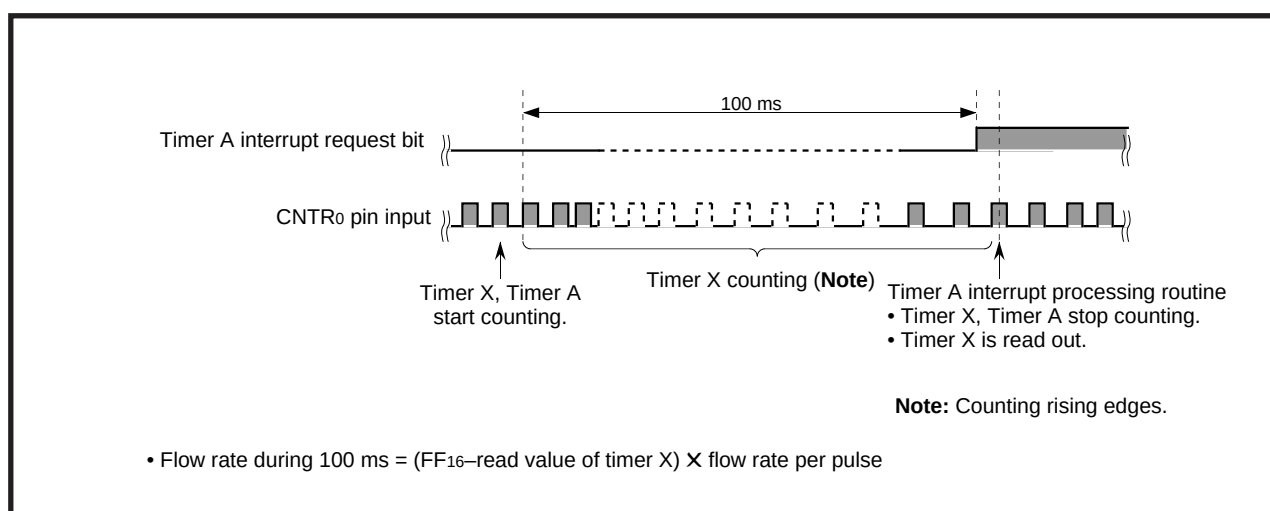


Figure 2 Method of measuring water flow rate

3.3 Example of Control Procedure

Figure 3 shows an example of control procedure.

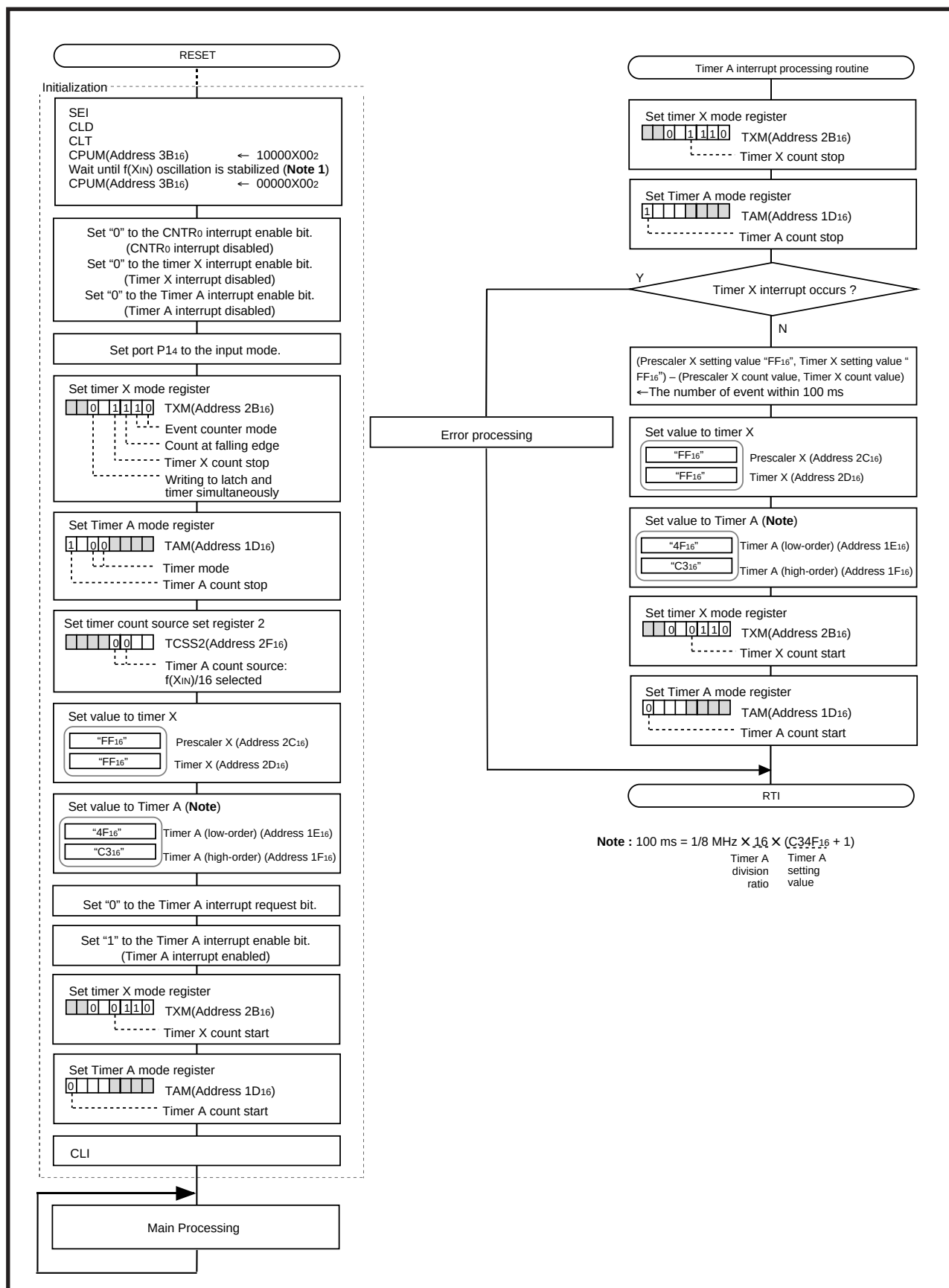


Figure 3 Example of control procedure

4. Sample Programming Code

```
[Reset Start ... Main Routine Process]

RESET:
    SEI                                ; Interrupt disable
    CLD
    CLT
;
    LDX    #$FF                        ; Set stack bottom
    TXS
;
    LDM    #%100000000,CPUM           ; Set CPU mode register
;
; Wait f(XIN) oscillation stabilizing time
;
    LDM    #%000000000,CPUM           ; Set CPU mode register
;
    LDA    #0
    LDX    #>RAM_top
RAM_clear: STA    $00,X
            INX
            BNE    RAM_clear
;
    CLB    5,ICON1                    ; disable CNTR0 interrupt
    CLB    7,ICON1                    ; disable Timer X interrupt
    CLB    2,ICON2                    ; disable timer A interrupt
;
    LDM    #%000000000,P1D            ; set P1_4 pin input mode
;
    LDM    #%00001110,TXM             ; event counter mode
;                                     ; CNTR0 interrupt priority : falling edge
;                                     ; stop timer X count
;
    LDM    #%100000000,TAM            ; timer mode
;                                     ; stop timer A count
;
    LDM    #%000000000,TCSS2          ; select timer A count source : f(XIN)/16
;
    LDM    #$FF,PREX                  ; Set Prescaler X
    LDM    #$FF,TX                   ; Set Timer X
;
    LDM    #$4F,TAL                   ; set timer A low-order
    LDM    #$C3,TAH                   ; set timer A high-order
;
    CLB    2,IREQ2                    ; clear timer A interrupt request
    SEB    2,ICON2                    ; enable timer A interrupt
    CLB    7,IREQ1                    ; clear timer X interrupt request
;
    CLB    3,TXM                      ; start timer X count
    CLB    7,TAM                      ; start timer A count
;
    CLI
;
__MAIN:
    BRA    __MAIN
;
```

Figure 4 Sample Programming Code (1)

[Timer A Interrupt Process]

```

__INT_timerA:
    CLD
    CLT
    PHA
;
    SEB 3,TXM          ; stop timer X count
    SEB 7,TAM          ; stop timer A count

    BBS 7,IREQ1,__ERROR ; input pulse is over 100ms
;
    SEC                ; event trigger count
    LDA #$FF
    SBC PREX
    STA RESULT+0
    SEC
    LDA #$FF
    SBC TX
    STA RESULT+1
    BRA __INT_timerA_01
;

__ERROR:
;
; error process
;

__INT_timerA_01:
    LDM #$FF,PREX      ; Set Prescaler X
    LDM #$FF,TX        ; Set Timer X
    LDM #$4F,TAL       ; set timer A low-order
    LDM #$C3,TAH       ; set timer A high-order

    CLB 3,TXM          ; start timer X count
    CLB 7,TAM          ; start timer A count

    PLA
    RTI
;

```

Figure 5 Sample Programming Code (2)

5. Reference

Data Sheet

7544 Group Data sheet

7544 Group Data sheet (QzROM Version)

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REVISION HISTORY	7544 Group Timer X Operation (Event Counter Mode)
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Rev.	Date	Description	
		Page	Summary
1.00	Apr 01, 2003	-	First Edition issued
2.00	Nov 12, 2004	3	Figure 3 revised.
		4-5	Sample Programming Code added.

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