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 $P1_4$/$CNTR_0$ 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 MHz, high-speed mode

3.1 Example of Peripheral Circuit

Figure 1 shows an example of a peripheral circuit.

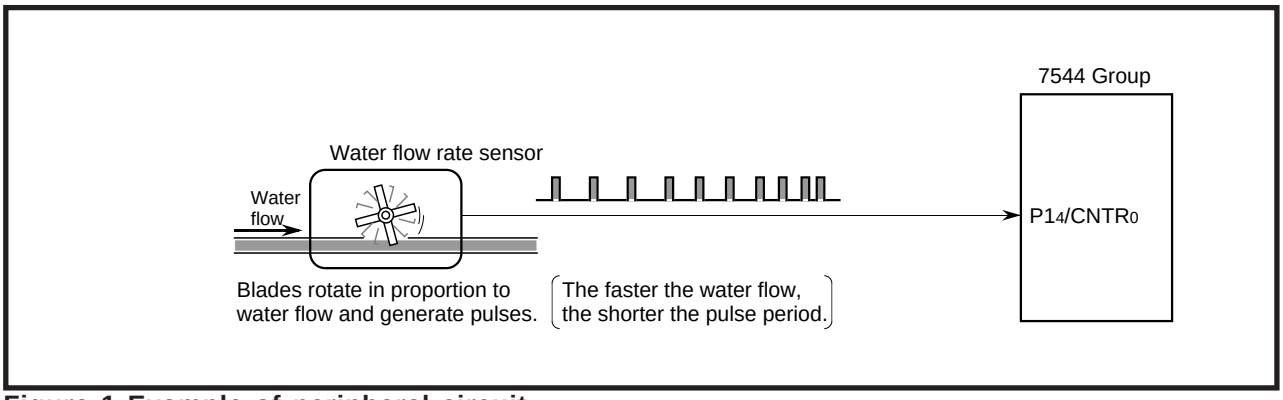

Figure 1 Example of peripheral circuit

3.2 Method of Measuring Water Flow Rate

Figure 2 shows the method of measuring water flow rate.

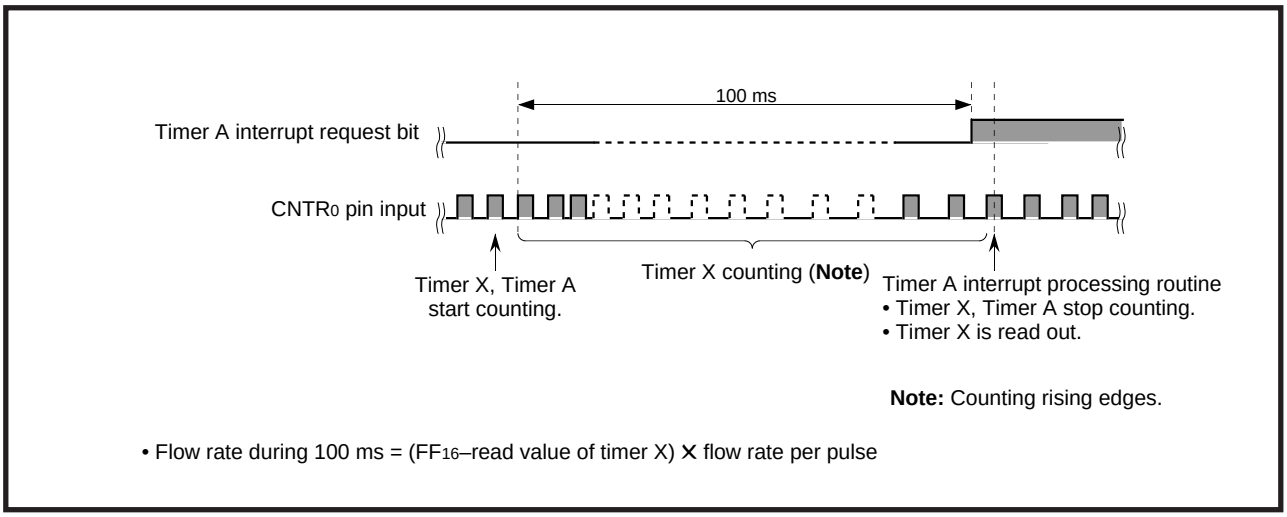

Figure 2 Method of measuring water flow rate

3.3 Example of Control Procedure

Figure 3 shows an example of control procedure.

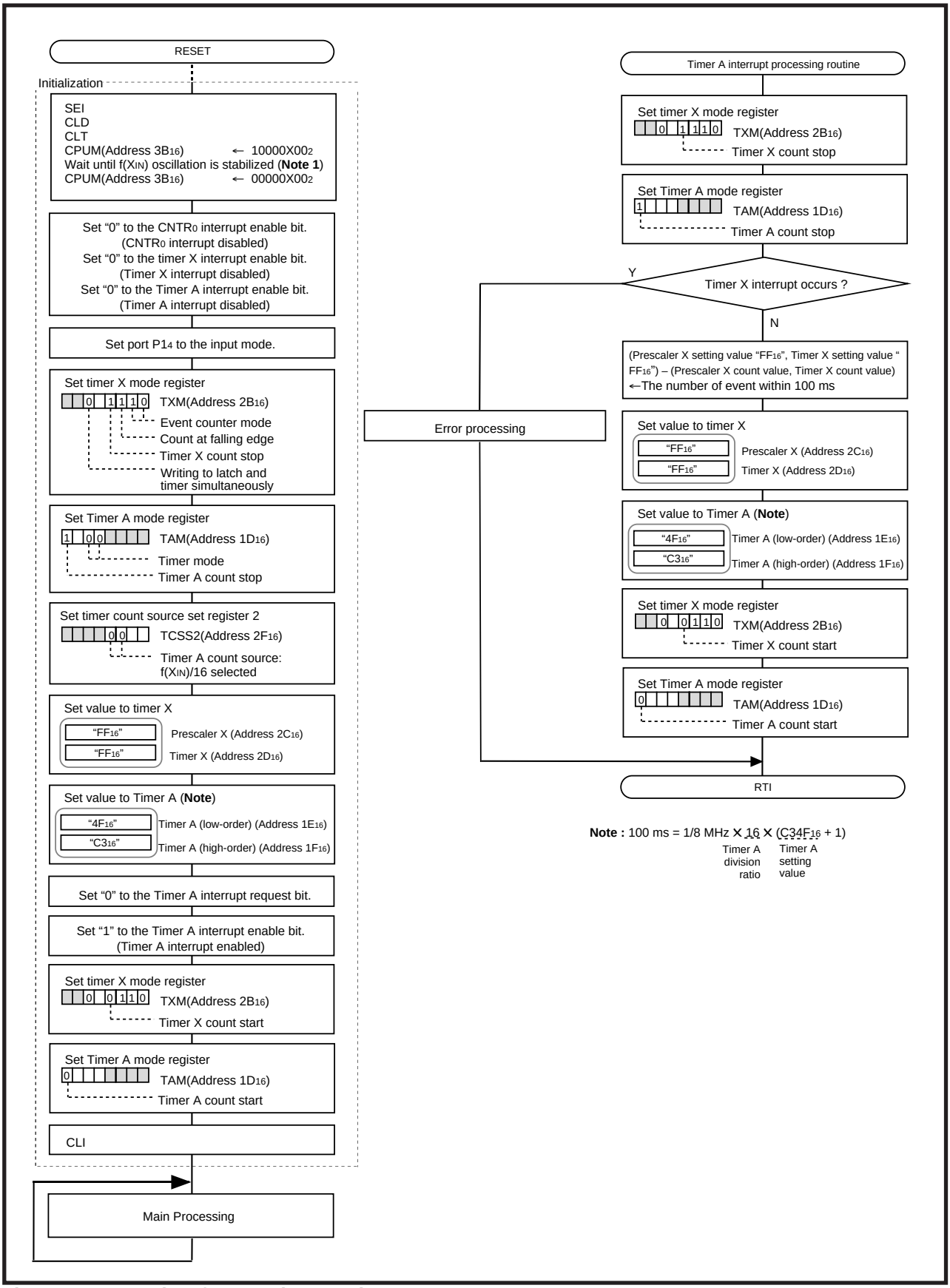

Figure 3 Example of control procedure

4. Sample Programming Code

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

RESET:
          SEI                       ; Interrupt disable
          CLD
          CLT
;
          LDX  #$FF                 ; Set stack bottom
          TXS
;
          LDM  #%10000000,CPUM      ; Set CPU mode register
;
; Wait f(XIN) oscillation stabilizing time
;
          LDM  #%00000000,CPUM      ; Set CPU mode register
;
          LDA  #0
          LDX  #>RAM_top
RAM_clear:STA  $00,X
          INX
          BNE  RAM_clear
;
          CLB  5,ICON1              ; disable CNTR0 interrupt
          CLB  7,ICON1              ; disable Timer X interrupt
          CLB  2,ICON2              ; disable timer A interrupt
;
          LDM  #%00000000,P1D       ; set P1_4 pin input mode
;
          LDM  #%00001110,TXM       ; event counter mode
                                    ; CNTR0 interrupt priority : falling edge
                                    ; stop timer X count
;
          LDM  #%10000000,TAM       ; timer mode
                                    ; stop timer A count
;
          LDM  #%00000000,TCSS2     ; select timer A count source : f(XIN)/16
;
          LDM  #$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              ; cleat 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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E-mail: support_apl@renesas.com

REVISION HISTORY	7544 Group Timer X Operation (Event Counter Mode)

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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