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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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H8S / 2200 Series

Measuring the Phase Difference of Two-Phase Pulse

Introduction

The phase difference of pulses with individual phases which is input to the external clock pin is measured using the 16-bit counter, and stores the result in the RAM.

Target Device

H8S / 2238

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1. Specifications

Measures the difference between the two-phase-encoder pulses which are input to the external clock pins TCLKA and TCLKB, and places the numbers obtained by counting up and down within the measurement time in RAM, as shown in figure 1.

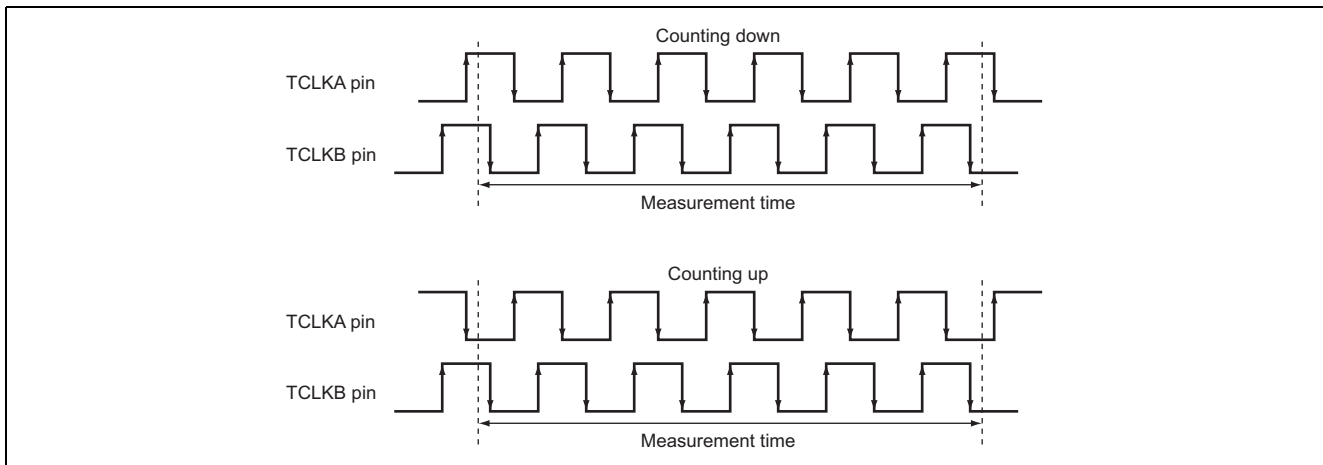


Figure 1 Counting the Number of Pulses from a Two-Phase Encoder

2. Description of Function Usage

(1) TPU1 is used to count pulses from a two-phase encoder.

- (a) TPU1 (phase measurement mode): Measures the phase difference between two-phase-encoder pulses input to the external clock pins, TCLKA and TCLKB, and counts up and down.
- (b) The value of a timer unit's counter (driven by the external clock) is transferred to the corresponding general register (input capture) in response to a compare-match on the other channel.

Figure 2 is a block diagram of the functions used in counting the pulses from the two-phase encoder.

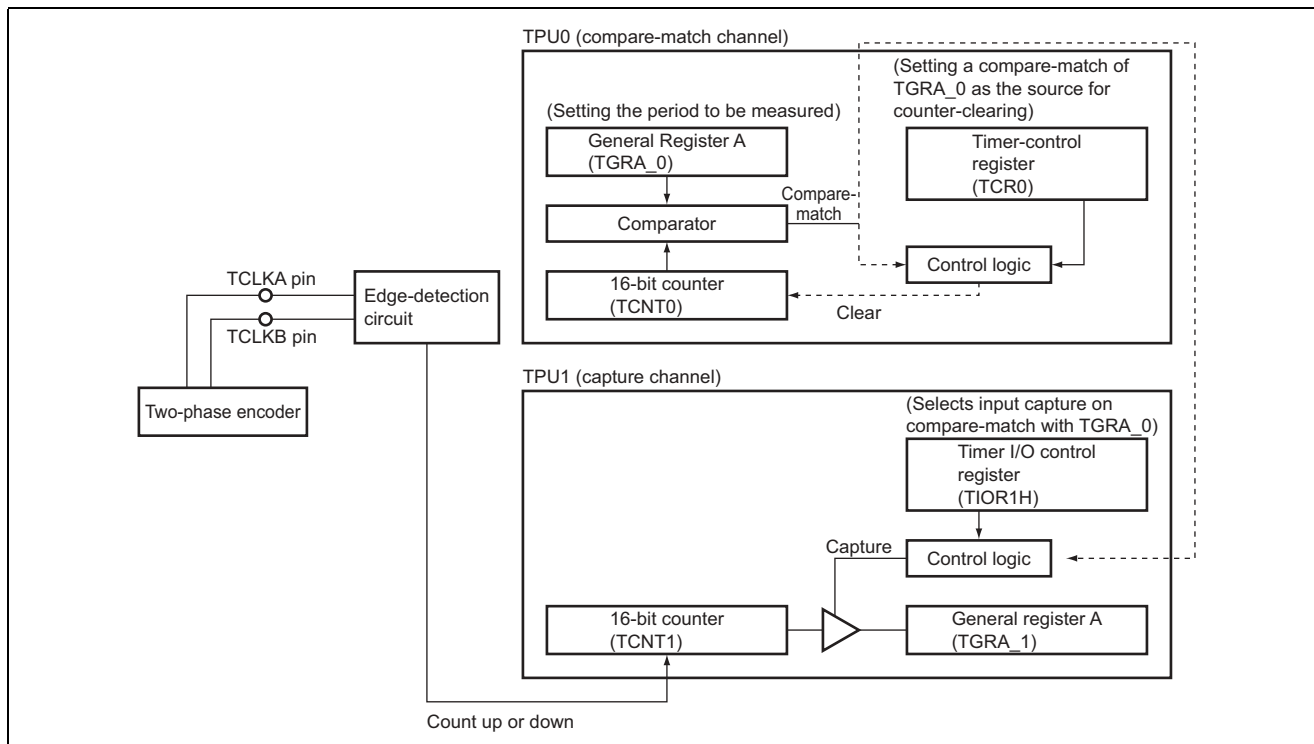


Figure 2 Block Diagram of Counting the Two-Phase Encoder

(2) The registers used and their functions are described in table 1. As the table shows, counting of pulses from the two-phase encoder is handled by the functions of the H8S / 2238.

Table 1 Function Assignments

Element	Description
TCLKA, B	Input pin for the pulses from the two-phase encoder
TCR0	Selects compare-match of TGRA_0 as the source for counter-clearing
TGRA_0	Sets measurement time
TIOR1	Selects input capture on compare-match with TGRA_0
TGRA_1	Sets the results counted by the input-capture A

3. Principles of Operation

Counting-up operation is depicted in figure 3. As the figure shows, a combination of hardware and software processing by the H8S / 2238 handles counting pulses from the two-phase encoder

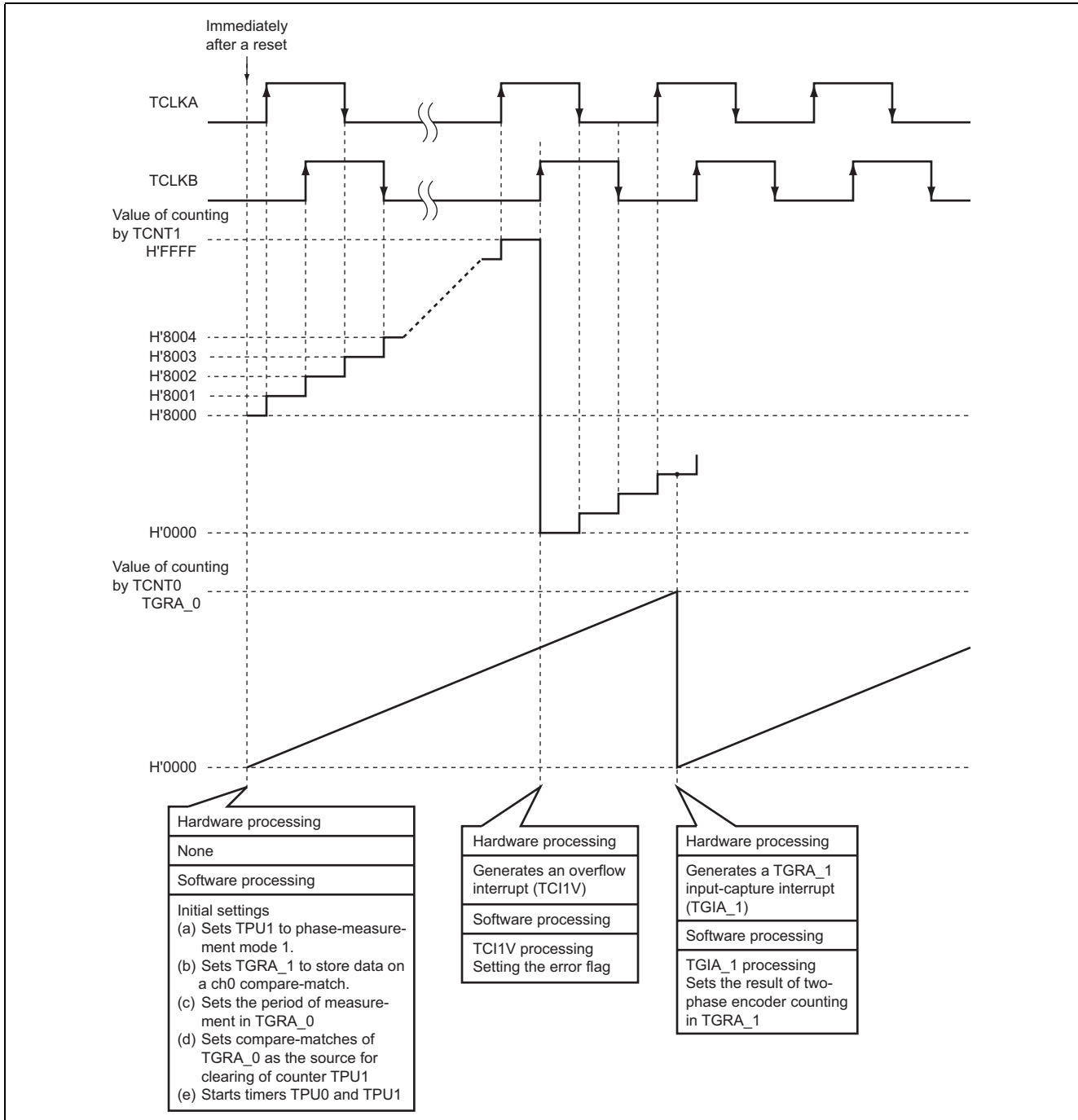


Figure 3 How the Signal from the Two-Phase Encoder Drives Counting Up

The count-down operation is depicted in figure 4. As the figure shows, pulses from the two-phase encoder are counted through a combination of hardware and software processing by the H8S / 2238.

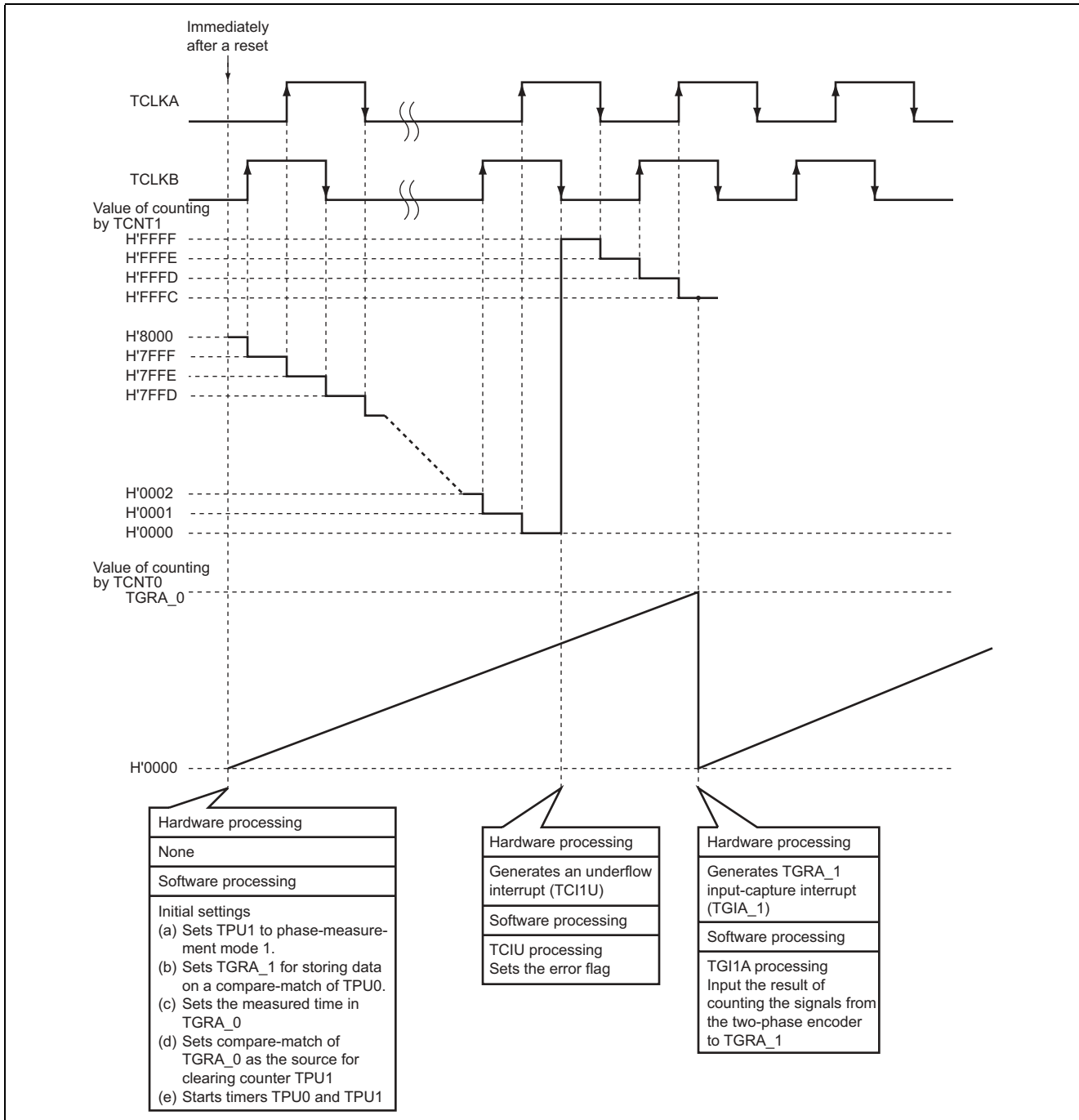


Figure 4 How the Signal from the Two-Phase Encoder Drives Counting Down

4. Software Description

(1) Function

Function	Label	Description
Main routine	cntmn	Initial settings for counting of the two-phase encoder signals
Capture interrupt	ramset	Stores the result of counting in RAM
Overflow detection	error1	Sets the overflow-generation flag
Underflow detection	error2	Sets the underflow-generation flag

(2) Arguments

Label	Description	Data Length	Used in	I/O
count	Sets the counting results within the measured time	unsigned short	capture interrupt	Output
err_over	Indicates whether or not an overflow occurred 1: Overflow 0: No overflow	unsigned char	Detection of overflow	Output
err_under	Indicates whether or not an underflow occurred 1: Underflow 0: No underflow	unsigned char	Detection of underflow	Output
cnttime	Sets the measured time	unsigned short	Main routine	Input

(3) Internal Registers

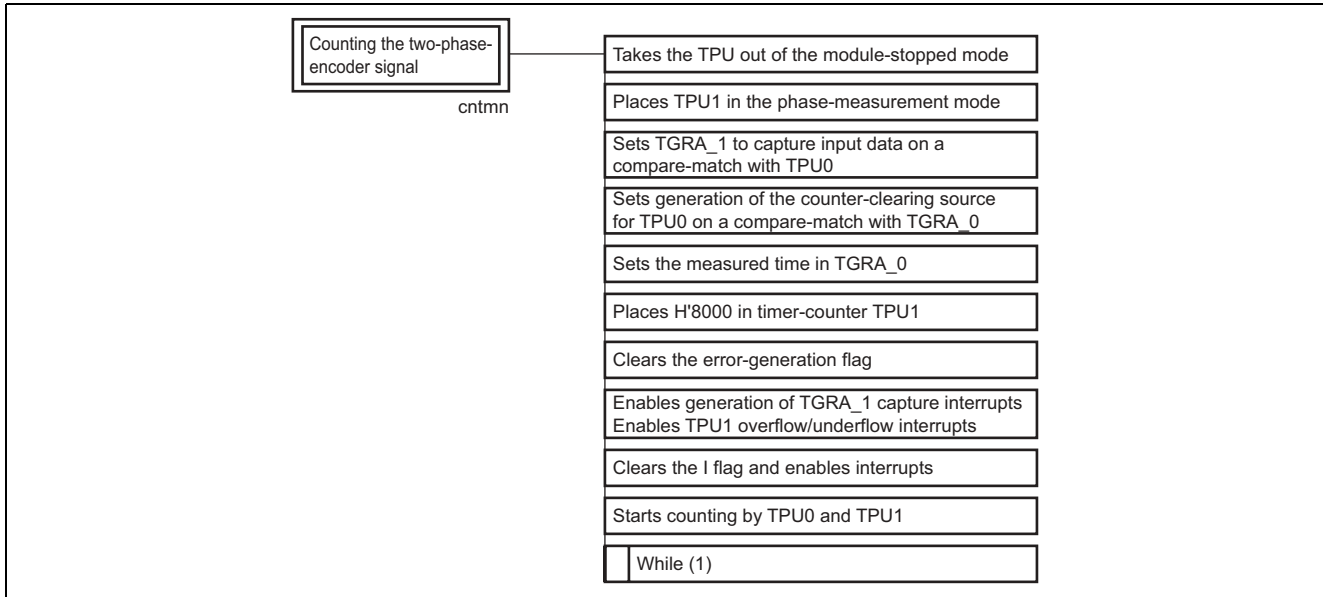
Register	Description	Used in
TSTR	Starts and stops counting by the TPU0 and TPU1 timer counters	Main routine
TCR0	Sets a compare-match of TGRA_0 as the source for counter clearing	Main routine
TIOR0	Sets TGRA_0 as the output-compare register	Main routine
TMDR1	Places TPU1 in phase-measurement mode 1	Main routine
TCR1	Sets a compare-match of TGRA_0 as the source for counter clearing	Main routine
TIOR1	Sets TGRA_1 for input capture on compare-match of TGRA_0	Main routine
TCNT1	Sets H'8000 as the initial value	Main routine
TIER1	Enables interrupt requests by the TGFA, TCFU, or the TCFV bit	Main routine
TSR1	Enables input capture and overflow/underflow interrupts	Main routine, capture interrupt
MSTPCR	Takes the TPU out of the module-stopped mode	Main routine

(4) RAM Usage

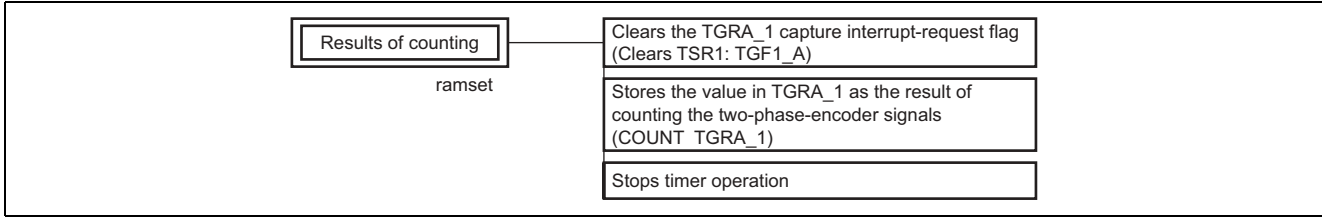
Internal RAM other than that for argument-storage is not used.

5. PAD

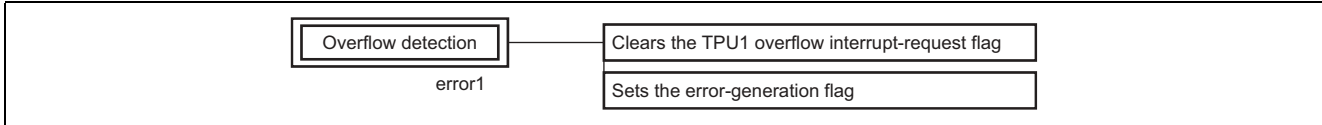
(1) Main routine



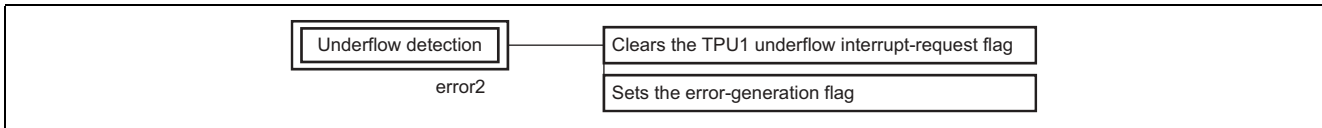
(2) Capture Interrupts



(3) Overflow Detection



(4) Underflow Detection



Revision Record

Rev.	Date	Description	
		Page	Summary
1.00	Mar.16.04	—	First edition issued

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