RX630 Group

MTU2a Operation in Phase Counting Mode

Abstract

This document describes operation of RX630 Group multi-function timer pulse unit 2 (MTU) in phase counting mode.

Products

RX630 Group

Contents

1. Overview

In this mode, the counter is incremented or decremented according to the phase difference between two externally generated input pulses (A-phase and B-phase) such as two-phase encoder pulses.

When this mode is selected, externally generated input pulses are used as count sources regardless of the TCR.TPSC[2:0] bit setting. The counter is incremented or decremented according to the input pulse phase difference regardless of the TCR.CKEG[1:0] bit setting. The input capture/output compare function and interrupt function can be used by setting the TCR.CCLR[2:0] bits and registers TIOR, TIER, and TGR.

Read the TSR.TCFD bit to check whether the counter is incremented or decremented.

Table 1.1 lists the channels and pins used in this mode.

Table 1.1　　Channels and Input Pins Used in Phase Counting Mode

Channel	Input Pin	
	A-phase	B-phase
MTU1	MTCLKA	MTCLKB
MTU2	MTCLKC	MTCLKD

2. Types of Phase Counting Mode

This mode is divided into phase counting mode 1 to phase counting mode 4 depending on the condition to increment/decrement the counter.

Figure 2.1 shows the types of phase counting mode and the corresponding input pulse patterns. Table 2.1 lists conditions to increment/decrement the counter.
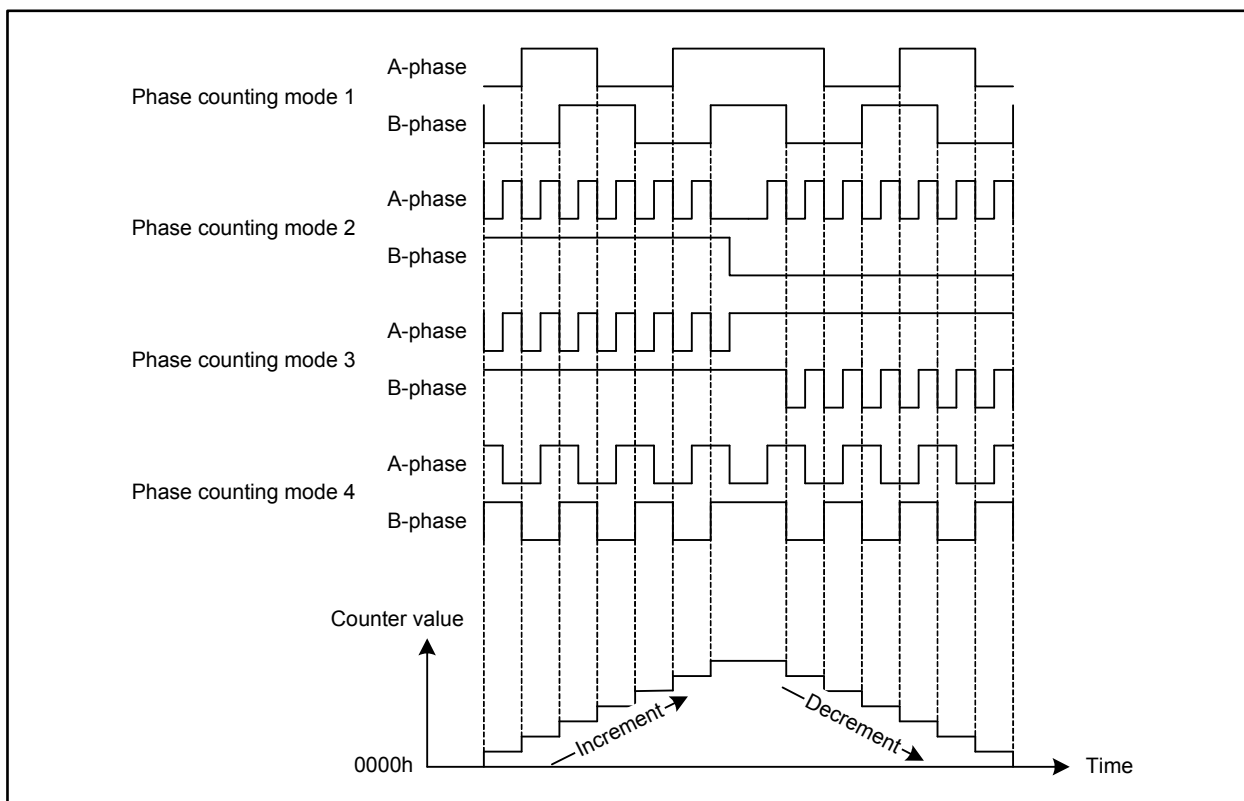

Figure 2.1   Types of Phase Counting Mode

Table 2.1   Conditions to Increment/Decrement the Counter

A-phase	B-phase	Phase Counting Mode			
		1	2	3	4
High	Rising edge	Incremented	Not changed	Not changed	Incremented
Low	Falling edge	Incremented	Not changed	Not changed	Incremented
Rising edge	Low	Incremented	Not changed	Not changed	Not changed
Falling edge	High	Incremented	Incremented	Incremented	Not changed
High	Falling edge	Decremented	Not changed	Decremented	Decremented
Low	Rising edge	Decremented	Not changed	Not changed	Decremented
Rising edge	High	Decremented	Not changed	Not changed	Not changed
Falling edge	Low	Decremented	Decremented	Not changed	Not changed

3. Setting Phase Counting Mode

Figure 3.1 shows an example of the procedure for setting phase counting mode.
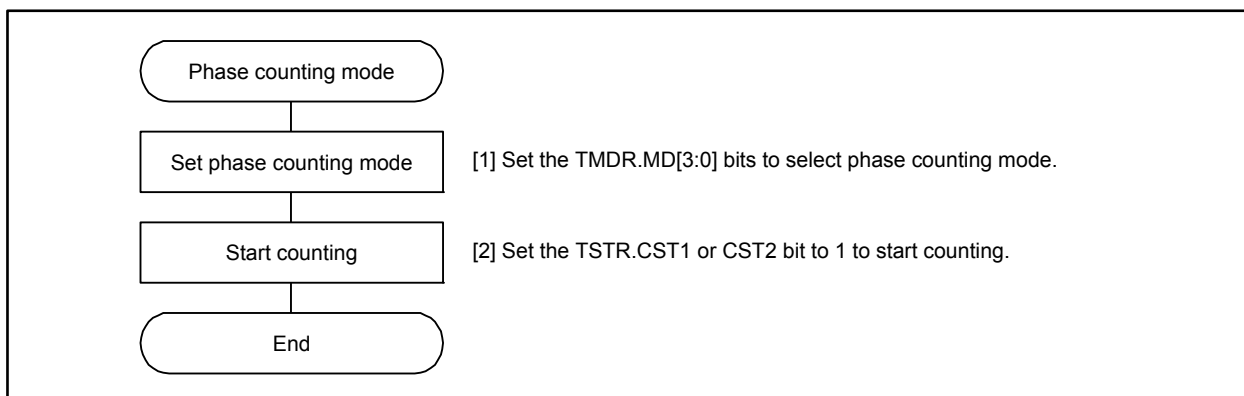

Figure 3.1   Example of Setting Phase Counting Mode

4. Interrupts

In phase counting mode, a TCIV interrupt request is generated when the counter overflows while the MTUn.TIER.TCIEV bit is 1 (n = 1, 2). A TCIU interrupt request is generated when the counter underflows while the MTUn.TIER.TCIEU bit is 1.

5. Application Example of Phase Counting Mode

Figure 5.1 shows an example of inputting two-phase encoder pulses from a servomotor to measure its speed and position.

In this example, MTU1 is set to phase counting mode 1, and A-phase and B-phase of the encoder pulses are input to pins MTCLKA and MTCLKC.

The speed control loop period is set in the MTU0.TGRA register, and the position control loop period is set in the MTU0.TGRC register. The MTU1.TCNT register value is captured each period. The speed and position can be measured by comparing the register value and the number of counts per revolution.

The MTU0.TCNT register value is captured in the MTU0.TGRB register using both edges of two-phase encoder pulses as a source for input capture. The MTU0.TGRD register is used as a buffer register of the MTU0.TGRB register. The widths of two-phase encoder pulses can be measured by calculating the difference between those register values.
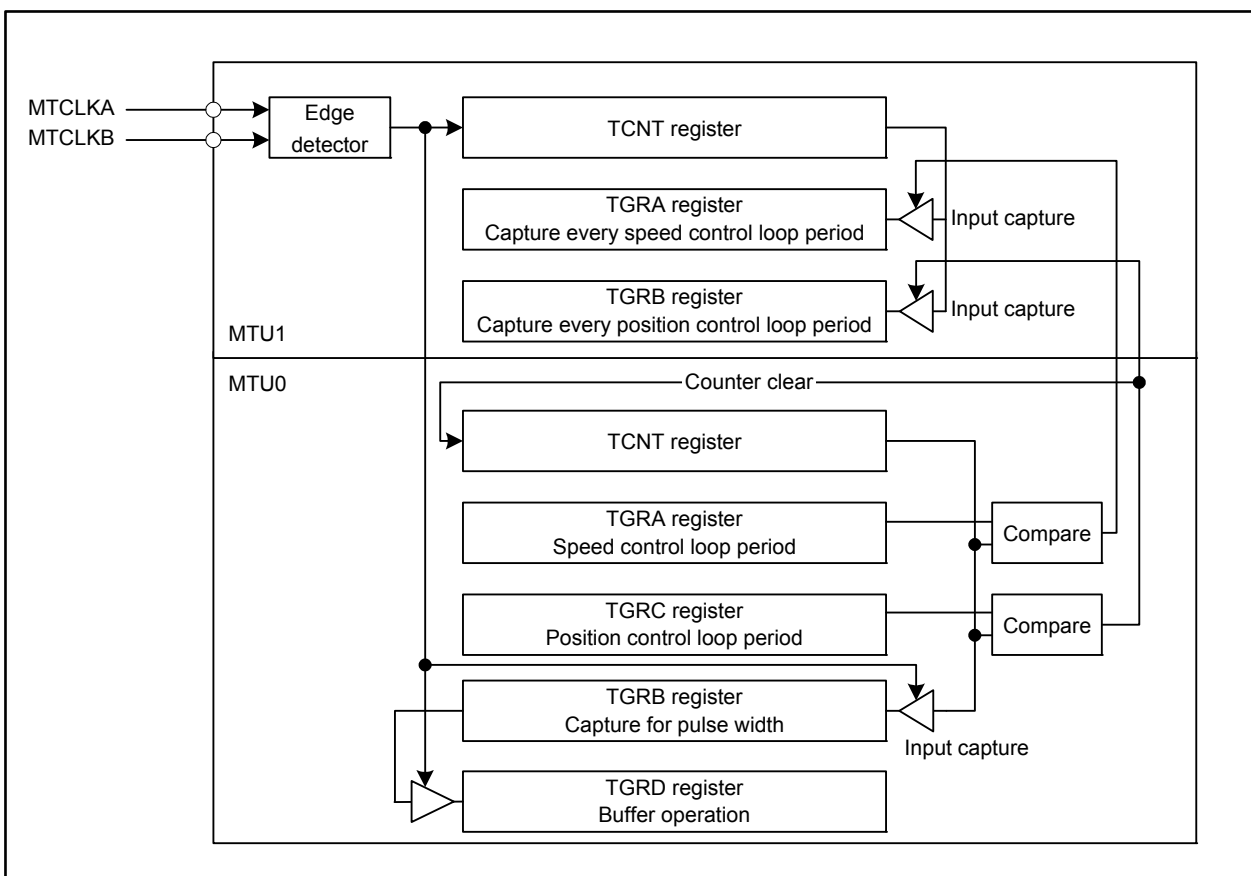
Figure 5.1   Application Example of Phase Counting Mode

6.   Reference Documents

User's Manual: Hardware
RX630 Group User's Manual: Hardware Rev.1.20
The latest version can be downloaded from the Renesas Electronics website.

Technical Update
The latest information can be downloaded from the Renesas Electronics website.

Website and Support

Renesas Electronics website
http://www.renesas.com/

Inquiries
http://www.renesas.com/contact/

Revision History	RX630 Group MTU2a Operation in Phase Counting Mode		
	Description		
Rev.	Date	Page	Summary
		Page	Summary
1.00	Oct. 5, 2012	—	Initial release

General Precautions in the Handling of MPU/MCU Products

The following usage notes are applicable to all MPU/MCU products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

1. Handling of Unused Pins

   Handle unused pins in accord with the directions given under Handling of Unused Pins in the manual.

   — The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible. Unused pins should be handled as described under Handling of Unused Pins in the manual.

2. Processing at Power-on

   The state of the product is undefined at the moment when power is supplied.

   — The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the moment when power is supplied.
   In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the moment when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the moment when power is supplied until the power reaches the level at which resetting has been specified.

3. Prohibition of Access to Reserved Addresses

   Access to reserved addresses is prohibited.

   — The reserved addresses are provided for the possible future expansion of functions. Do not access these addresses; the correct operation of LSI is not guaranteed if they are accessed.

4. Clock Signals

   After applying a reset, only release the reset line after the operating clock signal has become stable. When switching the clock signal during program execution, wait until the target clock signal has stabilized.

   — When the clock signal is generated with an external resonator (or from an external oscillator) during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Moreover, when switching to a clock signal produced with an external resonator (or by an external oscillator) while program execution is in progress, wait until the target clock signal is stable.

5. Differences between Products

   Before changing from one product to another, i.e. to a product with a different part number, confirm that the change will not lead to problems.

   — The characteristics of an MPU or MCU in the same group but having a different part number may differ in terms of the internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

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