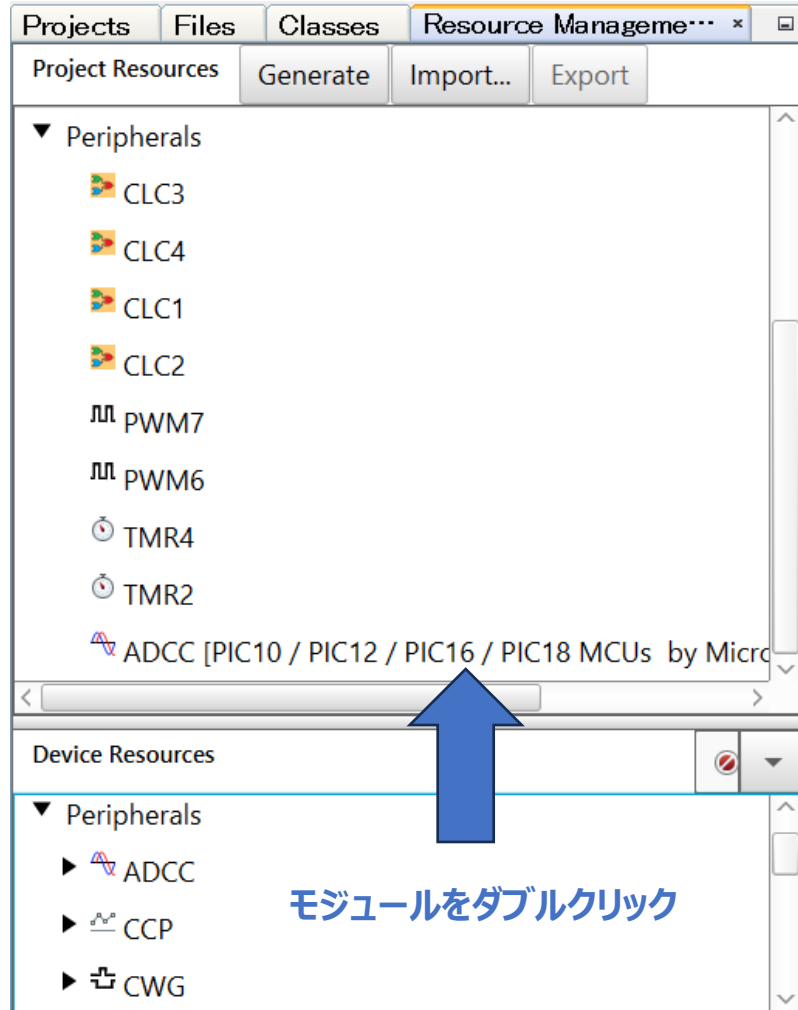


CLCモジュールを使ったRCサーボモーターの制御実験

MCC設定：PIC16F18424

1. 周辺モジュール選択



- Device ResourcesのPeripheralsから、使用する周辺モジュールをダブルクリックして、Project ResourcesのPeripheralsに組み込む。

2. Systemモジュール設定

System Module

Easy Setup Registers

INTERNAL OSCILLATOR

Current System clock 8 MHz

Oscillator Select HFINTOSC (PIC内蔵OSC)

External Clock Select Osc 8_MHz

HF Internal Clock 8_MHz → PLL Capable Frequency

External Clock 1 MHz

Clock Divider 1

WDT

Watchdog Timer Enable WDT Disabled, SWDTEN is ignored

Clock

Clock Source Software Control

Window Open Time window always open (100%); software control; keyed access not required

Time-out Period Divider ratio 1:65536; software control of WDTPS

Programming

Low-voltage Programming Enable

- 左シートの条件を設定.

3. TMR2モジュール設定

The screenshot shows the TMR2 configuration window with the following settings:

- Easy Setup / Registers** tabs are visible at the top.
- Enable Timer** is checked.
- Control Mode** is set to **Roll over pulse**.
- Ext Reset Source** is set to **T2CKIPPS pin**.
- Start/Reset Option** is set to **Software control**.
- Timer Clock** section:
 - Clock Source** is set to **FOSC/4**.
 - Clock Frequency** is **32.768 kHz**.
 - Polarity** is set to **Rising Edge**.
 - Prescaler** is set to **1:128**.
 - Postscaler** is set to **1:2**.
 - Enable Clock Sync** and **Enable Prescaler O/P Sync** are unchecked.
- Timer Period** section:
 - Timer Period** is set to **20.48 ms**, with a range of **128 us ≤ 20.48 ms ≤ 32.768 ms**.
 - Actual Period** is **20.48 ms**, with the note **(Period calculated via Timer Period)**.
- Software Settings** section:
 - Enable Timer Interrupt** is unchecked.
 - Callback Function Rate** is set to **0x0**, with the calculation **x Time Period = 0.0 ns**.

Annotations on the image:

- A blue dashed box highlights the **Clock Source**, **Clock Frequency**, **Polarity**, **Prescaler**, and **Postscaler** settings, with a callout bubble saying **この条件に設定** (Set to these conditions).
- A blue callout bubble points to the **Timer Period** input field, saying **制御パルス周期(20.48ms)入力** (Input control pulse period (20.48ms)).

- 左シートの条件を設定.

4. TMR4モジュール設定

The screenshot shows the TMR4 configuration window with the following settings:

- Hardware Settings:**
 - ☒ Enable Timer
 - Control Mode: Roll over pulse
 - Ext Reset Source: T4CKIPPS pin
 - Start/Reset Option: Software control
- Timer Clock:**
 - Clock Source: FOSC/4
 - Clock Frequency: 32.768 kHz
 - Polarity: Rising Edge
 - Prescaler: 1:16
 - Postscaler: 1:1
 - ☐ Enable Clock Sync
 - ☐ Enable Prescaler O/P Sync
- Timer Period:**
 - Timer Period: 8 us ≤ 2.048 ms ≤ 2.048 ms
 - Actual Period: 2.048 ms (Period calculated via Timer Period)
- Software Settings:**
 - ☐ Enable Timer Interrupt
 - Callback Function Rate: 0x0 x Time Period = 0.0 ns

Annotations in the image:

- A blue dashed box highlights the Clock Source, Clock Frequency, Polarity, Prescaler, and Postscaler settings.
- A blue callout box points to the Clock Frequency field with the text "この条件に設定".
- A blue callout box points to the Timer Period field with the text "PWM周期 上限値(2.048ms)を入力".

- 左シートの条件を設定.
※PWM 10 Bit分解能で動作させるにはTimer Periodの上限値に設定する.

5. ADCモジュール設定

ADCC

Easy Setup Registers

Hardware Settings

☒ Enable ADC

Operating Basic_mode

▼ ADC

ADC Clock

Clock Source FOSC/ADCLK

Clock FOSC/8

1 TAD 1.0 us

Sampling Frequency 86.9565kHz

Conversion Time = 11.5 * TAD = 11.5 us

Result Alignment right

Positive Reference VDD

Negative Reference VSS

Auto-conversion Trigger disabled

☐ Enable Continuous Operation

☐ Enable Stop on Interrupt

Acquisition Count 0 ≤ 16 ≤ 8191

Acquisition Time 2 us

☐ Enable Double Sample

► Computation Feature

► CVD Features

☐ Enable ADC Interrupt

☐ Enable ADC Threshold Interrupt

Selected Channels

Pin	Channel	Custom Name
RA5	ANA5	channel_ANA5
RA4	ANA4	channel_ANA4

- 左シートの条件を設定.

16F18424の 1 TAD(AD変換用クロック)範囲は 0.5us~9us (ADCクロック源がFoscのとき)

1 TAD=1usのConversion timeは11.5us
また、Acquisition time(標準値)は2us

従って、逐次AD変換時間(Conversion time + Acquisition time)は13.5us

6. PWM6/7モジュール設定

PWM6

Easy Setup Registers

Hardware Settings

☒ Enable PWM

Select a Timer : Timer4

Timer4 選択

Duty Cycle

Duty Cycle 72.1 %

PWMDC Value 737

PWMDC Value=制御ステップ中心になるDutyを設定

PWM Parameters

PWM Polarity active_hi

PWM Period 2.048 ms

PWM Frequency 488.28 Hz

PWM Resolution 10 Bits

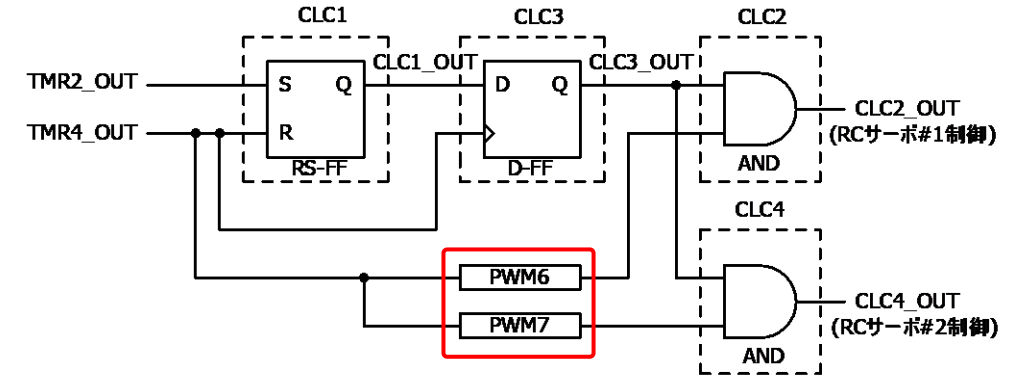
PWM分解能は10 Bit

ステップ数(10ビット)

制御パルス幅 [ms]

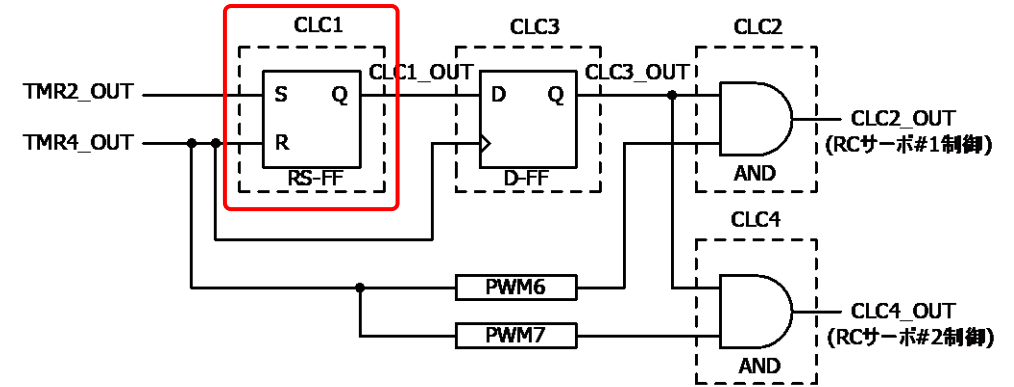
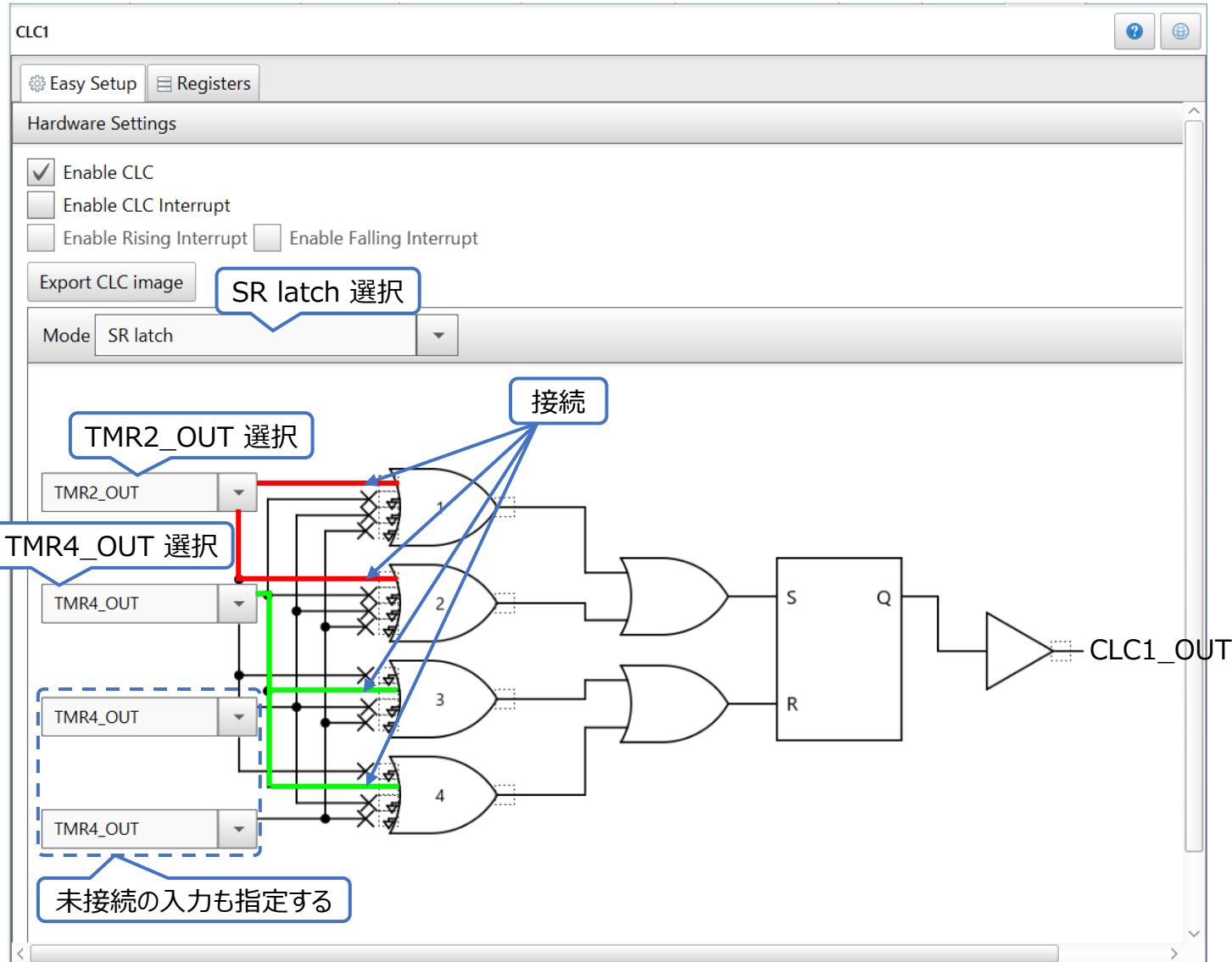
制御ステップ数:573

中心値



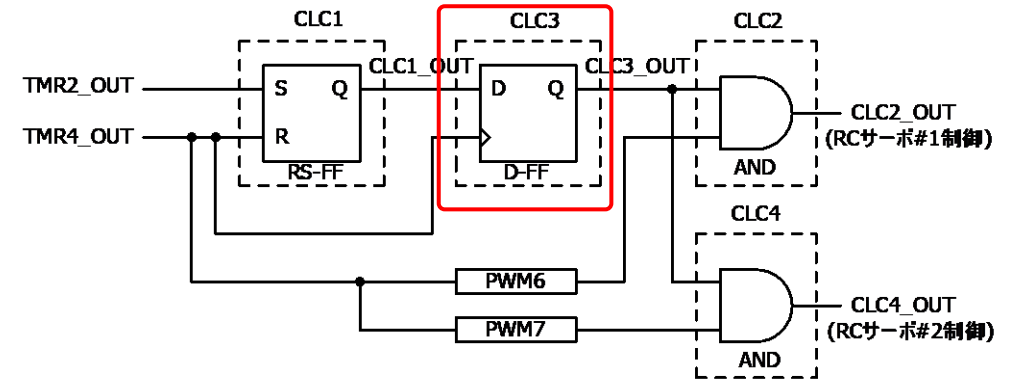
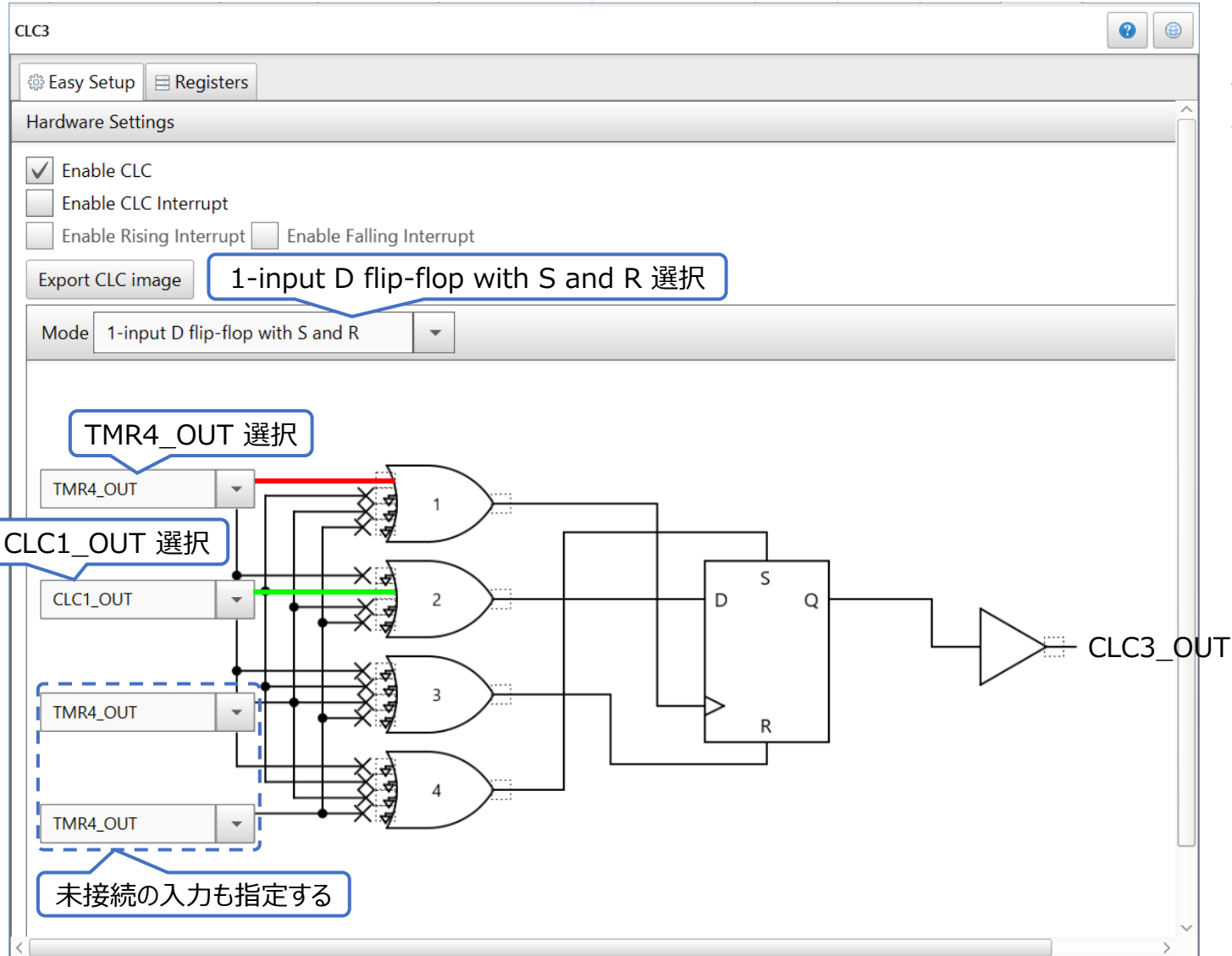
- PWM7モジュールも同じ設定.

7. CLC1(RS-FF)設定



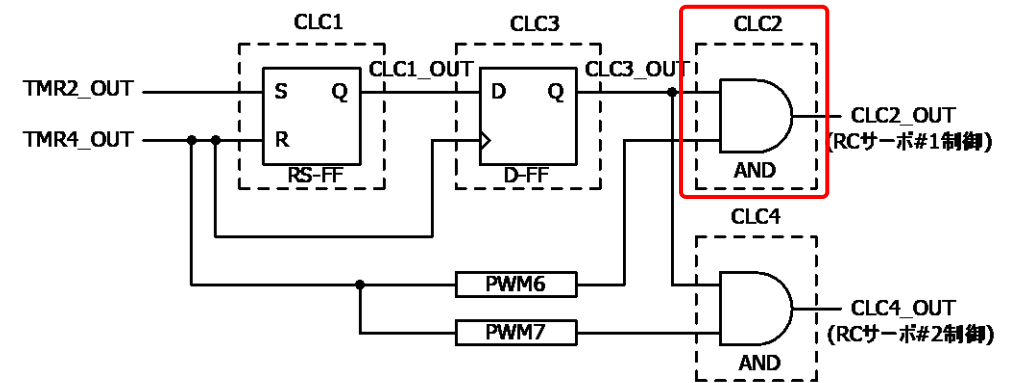
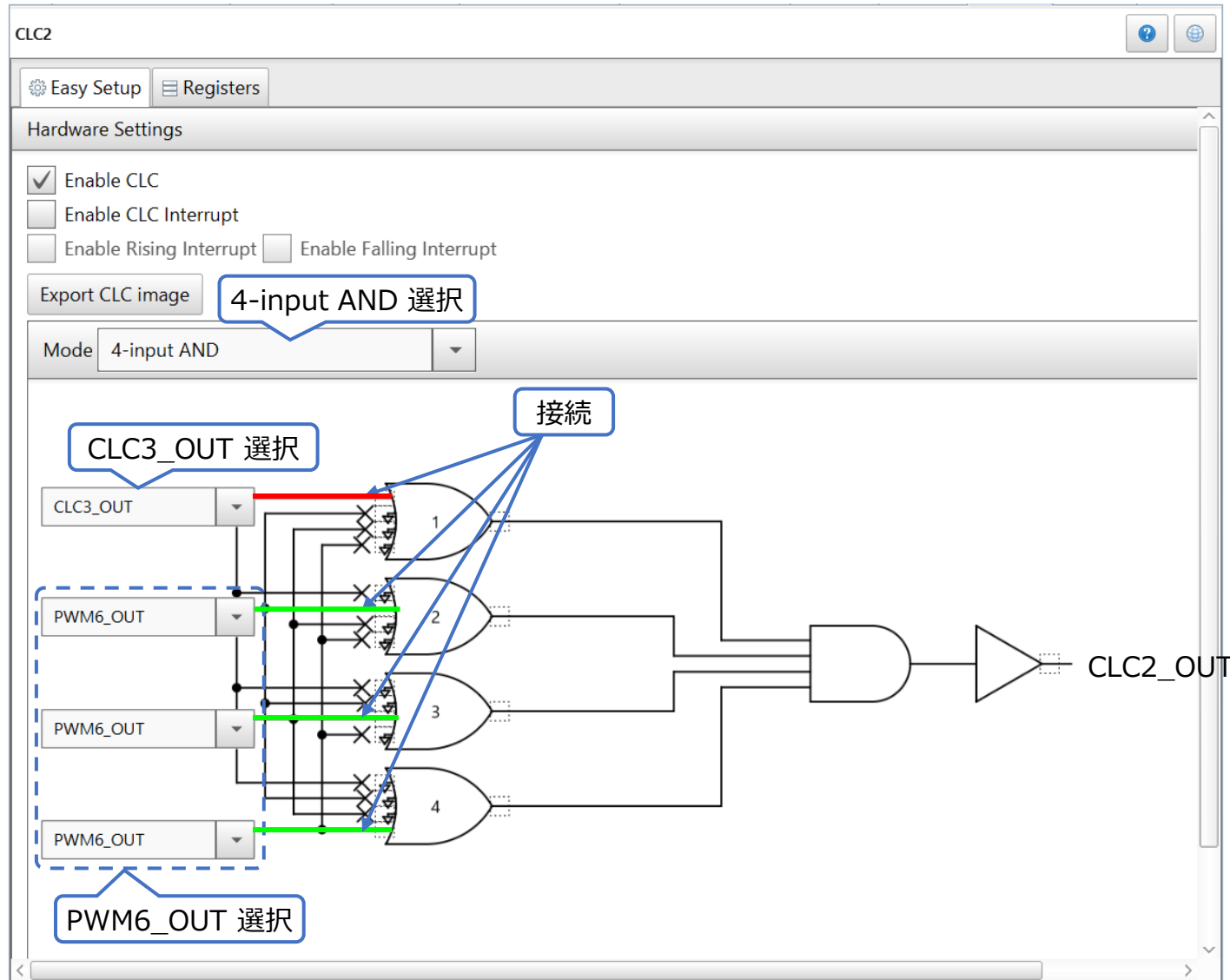
- ロジックの入力ラインの×をクリックして消すと接続状態になる。

8. CLC3(D-FF)設定



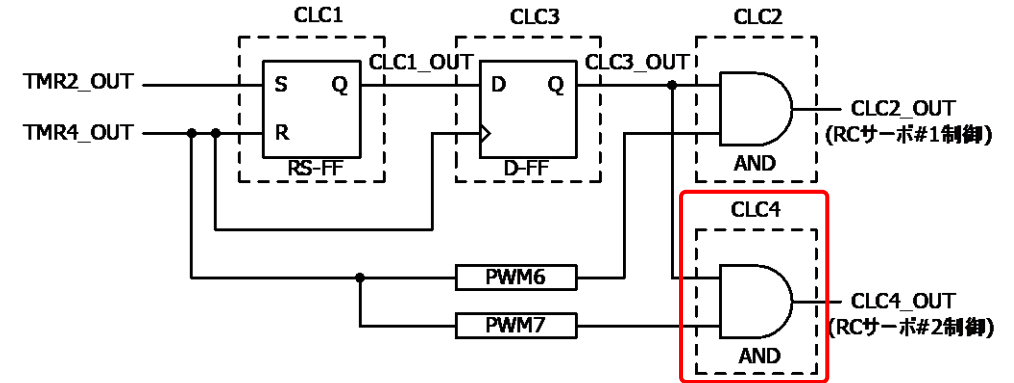
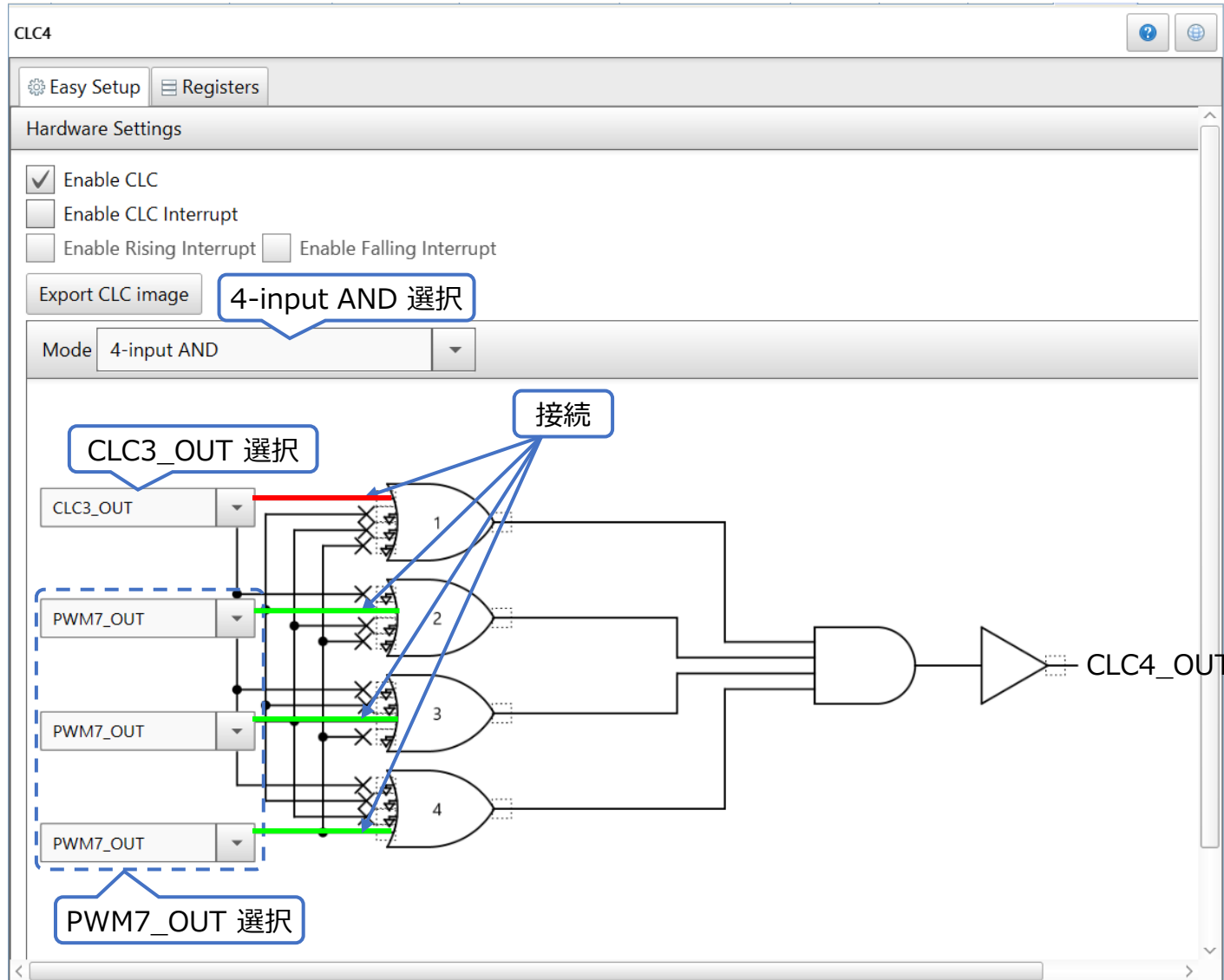
- ロジックの入カラインの×をクリックして消すと接続状態になる。

9. CLC2(AND回路)設定



- ロジックの入カラインの×をクリックして消すと接続状態になる.

10.CLC4(AND回路)設定



- ロジックの入カラインの×をクリックして消すと接続状態になる。

11.入出力Pin設定

Pin Module

Easy Setup

Registers

Selected Package : SOIC14

Pin Name ▲	Module	Function	Custom Na...	Start High	Analog	Output	WPU	OD	I/O C
RA4	ADCC	ANA4	channel_A		☒	☐	☐	☐	no... ▼
RA5	ADCC	ANA5	channel_A		☒	☐	☐	☐	no... ▼
RC2	CLC2	CLC2OUT			☒	☒	☐	☐	no... ▼
RC3	CLC4	CLC4OUT			☒	☒	☐	☐	no... ▼

VDD 1 14 VSS

RA5[channel_ANA5]ANA5 2 13 RA0

RA4[channel_ANA4]ANA4 3 12 RA1

RA3 4 11 RA2

RC5 5 10 RC0

RC4 6 9 RC1

RC3[CLC4OUT] 7 8 RC2[CLC2OUT]

MICROCHIP
PIC16F18424

Packa...	SOI...	▼	Pin No:	13	12	11	4	3	2	10	9	8	7	6	5
				Port A ▼					Port C ▼						
Module	Function	Direction	0	1	2	3	4	5	0	1	2	3	4	5	
ADCC ▼	ADCACT														
	ADCGR...	output	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
	ADCGRDB	output	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
	ANx	input	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
	VREF+	input		⌘											
	VREF-	input			⌘										
CLC1	CLC1OUT	output	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
CLC2	CLC2OUT	output	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
CLC3	CLC3OUT	output	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
CLC4	CLC4OUT	output	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
CLCx ▼	CLCIN0	input	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
	CLCIN1	input	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
	CLCIN2	input	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
	CLCIN3	input	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
OSC	CLKOUT	output					⌘								
PWM6	PWM6O...	output	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
PWM7	PWM7O...	output	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
Pin Modul...	GPIO	input	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
	GPIO	output	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
RESET	MCLR	input				⌘									
TMR2	T2IN	input	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘
TMR4	T4IN	input	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘	⌘

ジョイスティック_Y軸

ジョイスティック_X軸

RCサーボ#1へ

RCサーボ#2へ

END