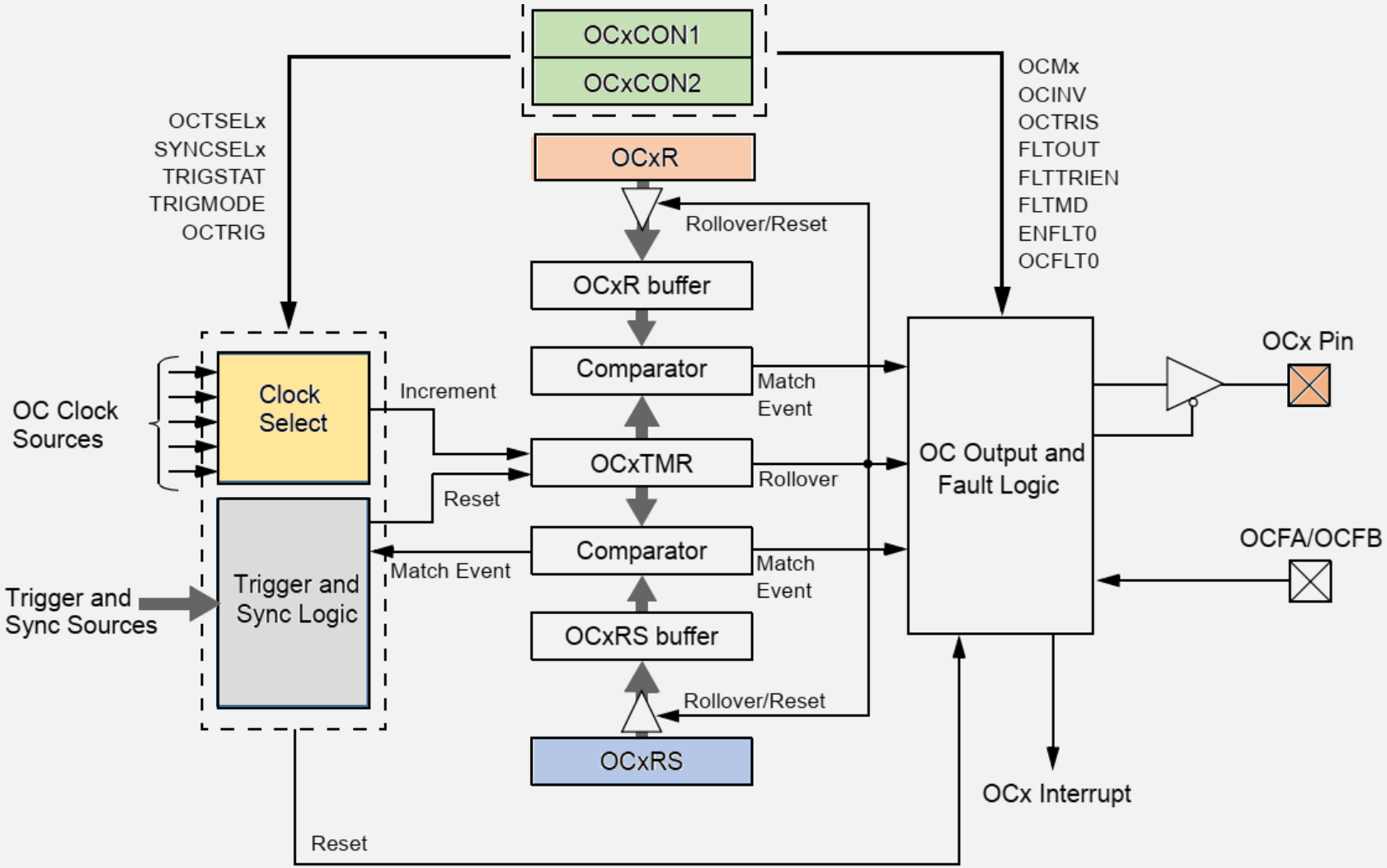
Output Compare modul

Output Compare modes (PWM)



OCxCON1 regiszter

U-0	U-0	R/W-0	R/W-0	R/W-0	R/W-0	U-0	U-0
—	—	OCSIDL	OCTSEL2	OCTSEL1	OCTSEL0	—	—
bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8

R/W-0	U-0	U-0	R/W-0,HCS	R/W-0	R/W-0	R/W-0	R/W-0
ENFLT0	—	—	OCFLT0	TRIGMODE	OCM2	OCM1	OCM0
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

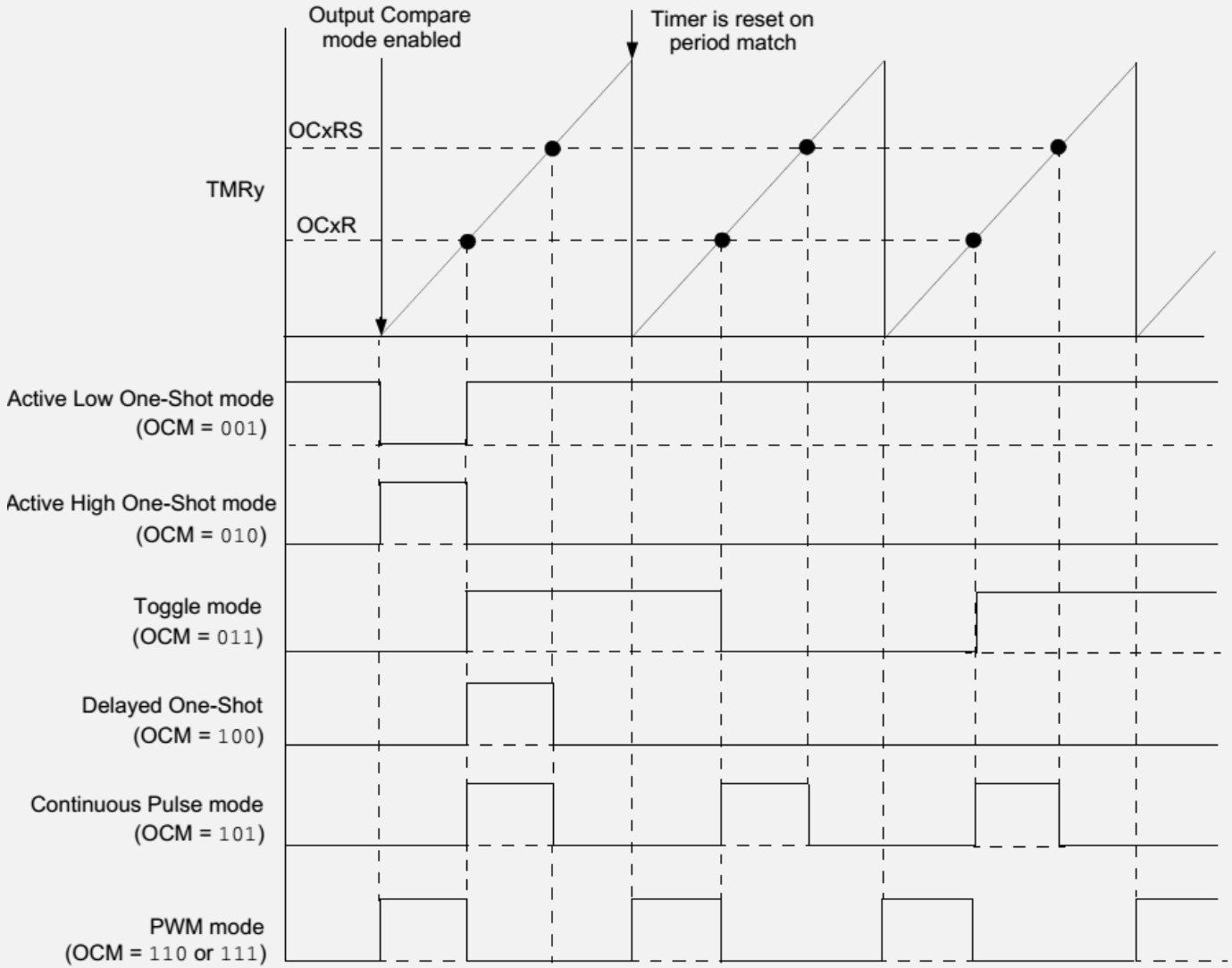
OCSIDL: Stop Output Compare x in Idle Mode Control bit
1 = Output Compare x halts in CPU Idle mode
0 = Output Compare x continues to operate in CPU Idle mode

OCTSEL<2:0>: Output Compare x Timer Select bits
111 = System Clock
110 = Reserved
101 = Reserved
100 = Timer1
011 = Timer5
010 = Timer4
001 = Timer3
000 = Timer2

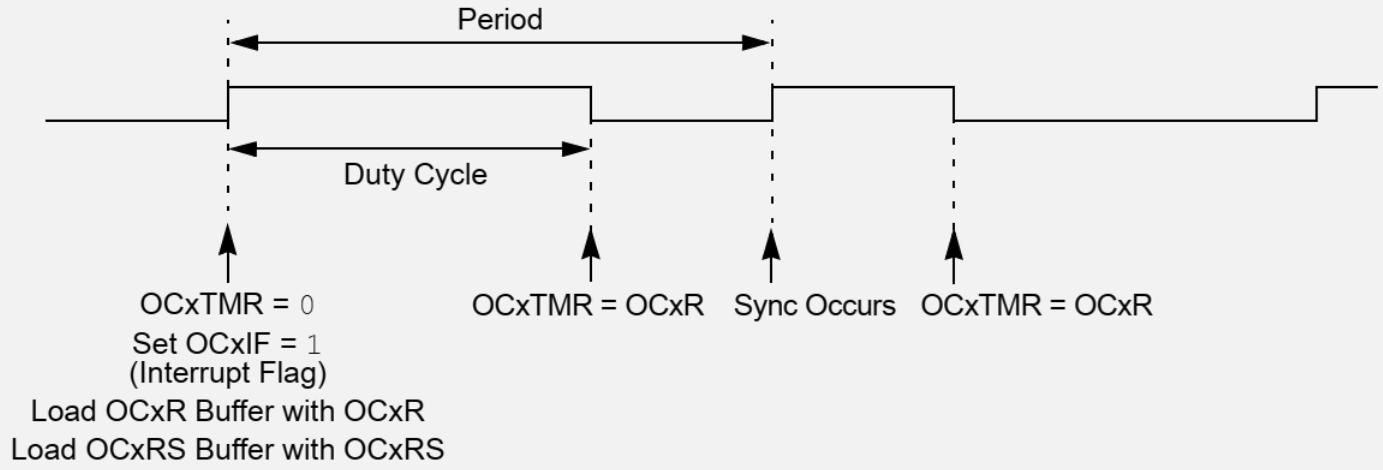
ENFLT0: Fault 0 Input Enable bit
1 = Fault 0 input is enabled
0 = Fault 0 input is disabled

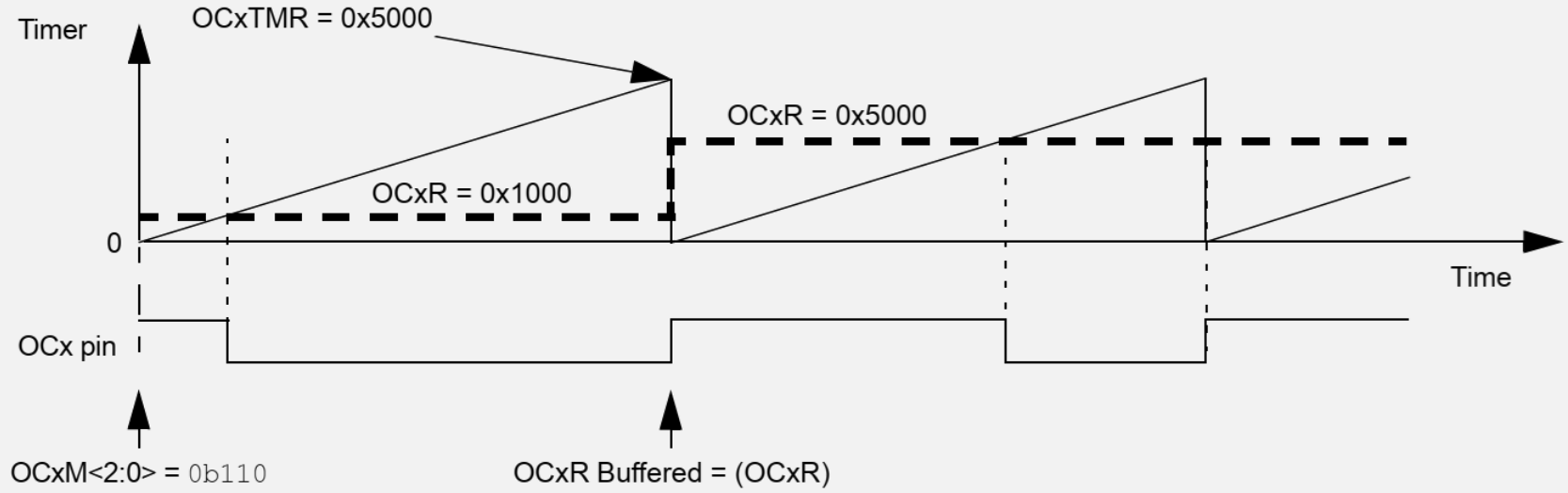
OCM<2:0>: Output Compare x Mode Select bits**(1)**
111 = Center-aligned PWM mode on OCx**(2)**
110 = Edge-aligned PWM Mode on OCx**(2)**
101 = Double Compare Continuous Pulse mode: Initialize OCx pin low, toggle OCx state continuously on alternate matches of OCxR and OCxRS
100 = Double Compare Single-Shot mode: Initialize OCx pin low, toggle OCx state on matches of OCxR and OCxRS for one cycle
011 = Single Compare Continuous Pulse mode: Compare events continuously toggle OCx pin
010 = Single Compare Single-Shot mode: Initialize OCx pin high, compare event forces OCx pin low
001 = Single Compare Single-Shot mode: Initialize OCx pin low, compare event forces OCx pin high
000 = Output compare channel is disabled

Output Compare modul



Edge-Aligned PWM Mode





OCxCON2 regiszter

R/W-0	R/W-0	R/W-0	R/W-0	U-0	U-0	U-0	R/W-0
FLTMD	FLTOUT	FLTTRIEN	OCINV	—	—	—	OC32
bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8

R/W-0	R/W-0 HS	R/W-0	R/W-0	R/W-1	R/W-1	R/W-0	R/W-0
OCTRIG	TRIGSTAT	OCTRIS	SYNCSEL4	SYNCSEL3	SYNCSEL2	SYNCSEL1	SYNCSEL0
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

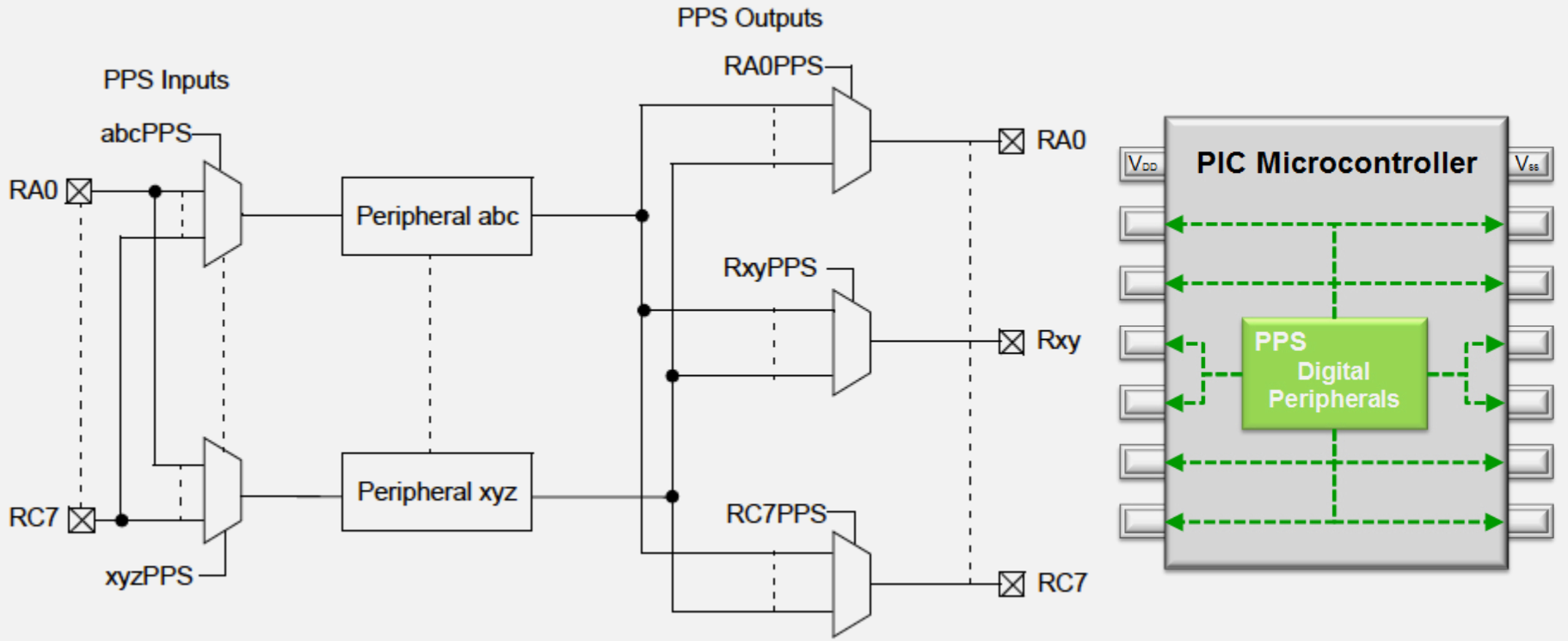
SYNCSEL<4:0>: Trigger/Synchronization Source Selection bits

11111 = This OC module
11110 = Input Capture 9
11101 = Input Capture 6
11100 = CTMU
11011 = A/D
11010 = Comparator 3
11001 = Comparator 2
11000 = Comparator 1
10111 = Input Capture 4
10110 = Input Capture 3
10101 = Input Capture 2
10100 = Input Capture 1
10011 = Input Capture 8
10010 = Input Capture 7
1000x = reserved

01111 = Timer 5
01110 = Timer 4
01101 = Timer 3
01100 = Timer 2
01011 = Timer 1
01010 = Input Capture 5
01001 = Output Compare 9
01000 = Output Compare 8
00111 = Output Compare 7
00110 = Output Compare 6
00101 = Output Compare 5
00100 = Output Compare 4
00011 = Output Compare 3
00010 = Output Compare 2
00001 = Output Compare 1
00000 = Not synchronized to any other module

Peripheral Pin Select (PPS)

A digitális ki/bemeneti egységek áthelyezetők különböző lábakra (egyedül az analóg funkciók kötöttek a belső kapcsolatok miatt pl. S&H, A/D átalakító)



Output Compare modes (PWM)

```
//Periféria - láb összerendelés PPS (pp.138)
__builtin_write_OSCCONL(OSCCON & 0xbf); //PPSUnLock;
   //PWM
   RPOR8bits.RP17R = 18;                //40-es láb (kék led) <- OC1 modul
__builtin_write_OSCCONL(OSCCON | 0x40); //PPSLock;
```

```
void pwmInit(int duty){
    OC1CON1 = 0;                  // OC modul beállításainak törlése
    OC1CON2 = 0;
    OC1CON1bits.OCTSEL = 7;       // rendszer órajelével működik
    OC1CON2bits.SYNCSEL = 0x1F; // szinkronizálás önmagával, OC1RS adja a periódust
    OC1RS = 1023;                 // periódus
    OC1R = duty;                  // kitöltés
    OC1CON1bits.OCM = 6;          // Edge Aligned PWM mode
}

void pwmSet(int duty){
     OC1R = duty;                 //következő kitöltés
}
```

Gyakorlás

Feladat

Az SW1 gomb megnyomásakor a kitöltés legyen: 10%
Az SW2 gomb megnyomásakor a kitöltés legyen: 50%
Az SW3 gomb megnyomásakor a kitöltés legyen: 90%

Feladat

Az SW1 gomb megnyomásakor a kitöltés növekedjen 10%-al.
Az SW2 gomb megnyomásakor a kitöltés csökkenjen 10%-al.

Output Compare modes (PWM)

10 kHz-es PWM előállítása Timer2-vel:

$$F_{CY} = \frac{F_{OSC}}{2} = \frac{32\ \text{MHz}}{2} = 16\ \text{MHz}$$

$$10\ \text{kHz} \rightarrow t = 100\ \text{us}$$

$$PR_x = \frac{F_{CY} \times \text{periódusidő}}{\text{prescaler}} - 1$$

$$PR_{max} = 2^{16} - 1 = 65535$$

$$PR2 = \frac{16\ \text{MHz} \times 100\ \text{us}}{1} - 1 = 1600 - 1$$

```
void pwmInitMotor(int duty){
    OC1CON1 = 0;                    // OC modul beállításainak törlése
    OC1CON2 = 0;
    OC1CON1bits.OCTSEL = 0;         // TMR2-vel működik
    OC1CON2bits.SYNCSEL = 0x0C;     // szinkronizálás TMR2-vel
    PR2 = 1600 - 1;                 // TMR2 periódusa
    TMR2 = 0;                       // TMR2 törése
    OC1R = duty;                    // kitöltés
    OC1CON1bits.OCM = 6;            // Edge Aligned PWM mode
    T2CONbits.TON = 1;              // TMR2 indul
}
```