

Signal frequency $F = 250 \text{ Hz}$.

Periodic time $P = 1 / F = 4 \text{ ms}$

$F_{osc} = 20 \text{ MHz} \Rightarrow \text{Timer frequency} = F_{osc} / 4 = 5 \text{ MHz}$.

Tic time = $1 / \text{Timer frequency} = 1 / 5 \text{ MHz} = 0.2 \mu\text{s}$.

R/W-1	R/W-1	R/W-1	R/W-1	R/W-1	R/W-1	R/W-1	R/W-1
TMR0ON	T08BIT	T0CS	T0SE	PSA	T0PS2	T0PS1	T0PS0
bit 7							bit 0

Register configurations:

- Timer on: set bit 7.
- Use 16-bit: reset bit 6.
- Timer: reset bit 5
- No Counter: reset bit 4
- No prescale: set bit 3
- Prescale value: reset bit 2
- Prescale value: reset bit 1
- Prescale value: reset bit 0

A. Duty cycle $D = 50\%$:

$$T_{on} = \frac{P * D}{100} = \frac{4 \text{ ms} * 50}{100} = 2 \text{ ms}$$

$$\text{Number of tics} = \frac{\text{Desired rime}}{\text{Tic time}} = \frac{2 \text{ ms}}{0.2 \mu\text{s}} = 10000 \text{ tic}$$

$$\text{Initial value} = 2^n - \text{Number of tics} = 2^{16} - 10000 = 55536 = D8F0_{16}$$

B. Duty cycle $D = 70\%$:

$$T_{on} = \frac{P * D}{100} = \frac{4 \text{ ms} * 70}{100} = 2.8 \text{ ms}$$

$$\text{Number of tics} = \frac{\text{Desired rime}}{\text{Tic time}} = \frac{2.8 \text{ ms}}{0.2 \mu\text{s}} = 140000 \text{ tic}$$

$$\text{Initial value} = 2^n - \text{Number of tics} = 2^{16} - 10000 = 51536 = C950_{16}$$

We also need to compute the rest of the signal tics (30%) :

$$T_{on} = \frac{P * D}{100} = \frac{4 \text{ ms} * 30}{100} = 1.2 \text{ ms}$$

$$\text{Number of tics} = \frac{\text{Desired rime}}{\text{Tic time}} = \frac{1.2 \text{ ms}}{0.2 \text{ }\mu\text{s}} = 6000 \text{ tic}$$

$$\text{Initial value} = 2^n - \text{Number of tics} = 2^{16} - 6000 = 59536 = E890_{16}$$