

Timers & PWM

Electrical Engineering

Period and duty cycle as counter values, and the arithmetic that connects them to hertz.

A timer counts clock ticks, so both period and duty cycle are simply counter values.

$$f_{\text{pwm}} = f_{\text{clk}} / (\text{prescaler} \times (\text{period} + 1))$$

72 MHz, prescale 72

1 μ s per count.

1 MHz tick

Period 999

1000 ticks.

1 kHz output

Compare at 250

250 of 1000.

25% duty cycle

THE COMMON MISTAKE

✗ **Making a waveform with delays in software**

✓ **Letting the timer generate it in hardware**

The timer keeps running while the CPU does other work. Software timing jitters with every interrupt that lands mid-pulse.

Frequency and resolution trade directly: a faster PWM leaves fewer counts per period, so fewer distinct duty levels.