

Understanding PWM for Servo Motors

This document explains PWM (Pulse Width Modulation) in simple terms for controlling hobby servo motors, especially 180° servos, using CircuitPython.

1. Frequency

Frequency is how often the PWM signal repeats. For servos, the standard frequency is **50 Hz** (50 times per second). That means each cycle is **20 milliseconds** long. Every cycle, the servo expects one control pulse that tells it what angle to move to.

2. Duty Cycle

Duty cycle is how long the signal stays HIGH within that 20 ms cycle. This ON-time (pulse width) tells the servo which angle to move to:

- ~1 ms (5% duty cycle) → 0° (far left)
- ~1.5 ms (7.5% duty cycle) → 90° (center)
- ~2 ms (10% duty cycle) → 180° (far right)

So, unlike an LED dimming case where you might use 50%, servos only care about a small duty range (5–10%).

Angle	Pulse Width	Duty Cycle (at 50Hz)	CircuitPython duty_cycle (0–65535)
0°	~1 ms	5%	3276
90°	~1.5 ms	7.5%	4915
180°	~2 ms	10%	6553

Key Takeaway:

For a 180° servo, use **50 Hz frequency** and vary the duty cycle only between **5%–10%**. In CircuitPython, this means setting the duty_cycle value between ~3276 and ~6553.