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## Delay Time Calculations

Crystal frequency = 22.1184 MHz = 22118400 Hz

$$\text{Internal frequency} = \frac{Crystal\ frequency}{12} = \frac{22118400}{12} = 1843200\ Hz\ (Cycles\ per\ second)$$

To calculate the number of cycles for a certain time *x* in *msec:*

$$Cycles(x) = \frac{x \times 1843200}{1000}\ clock\ cycles$$

Since we're using C (and not assembly), we need to calculate the number of loops required. The microcontroller has 8-bit registers so the maximum cycles for any loop is 256. The required clock cycles needed for the delay can be achieved through 3 nested loops. The two inner ones will be repeated for 256 times each, and each loop cycle consumes 2 clock cycles. So, we can get the number of times the outer loop should be repeated for a certain time x using this formula:

$$Outer\ loop\ count\ (x) = \left\lfloor \frac{Cycles(x)}{256^2 \times 2} \right\rfloor$$

Example: to achieve a delay of 500 msec

$$Number\ of\ cycles = \frac{500 \times 1843200}{1000} = 921600\ cycles$$

$$Outer\ loop\ count = \left\lfloor \frac{921600}{256^2 \times 2} \right\rfloor = 7$$

So, a delay of 500 msec can be achieved using 3 nested loops with counts of 7, 265 & 265 respectively.