

Lab 2 Square Waveform Generator

I. Objectives

- To trace through a CALL subroutine with simulator.
- To calculate delays of instructions.
- To create a simple square wave generator.

II. Materials

- Keil uVision3 development environment.
- 8051 hardware development kit (MDE-8051)
- Jumper kit

III. Procedures

Activity 1. Ports Toggling (Week 1)

1. Write and assemble a program to toggle all the bits of P0 continuously by sending 55H and AAH to these ports. Put a time delay between the “on” and “off” states. Achieve the time delay through a subroutine DELAY, which executes 10 null loops
(E.g. the following code corresponds to 1 null loop
MOV R1, #1
HERE: DJNZ R1, HERE ; 4 machine cycles per loop)
2. Using a simulator to single step through the program. Examine the contents of the register in the DELAY subroutine.
3. Change the DELAY subroutine to 300 null loops. Load your program to the board. Connect P0.1 to oscilloscope, and P0.3 to LED. Use the oscilloscope to measure the frequency.
4. Change the DELAY subroutine to 400 null loops. Use the oscilloscope to measure the frequency.

Activity 2. Machine Cycles and Delay (Week 1)

1. Finish Questions 1 and 2 in Section IV.
2. Change the DELAY subroutine in Activity 1 to a delay of 10 ms. What is the frequency and period of the square wave? Use the oscilloscope to measure the frequency and period.

Activity 3. Square wave generator (Week 2)

1. The duty cycle of a square wave is defined as the duration of high divided by the period of one complete cycle. What is the duty cycle of the square wave in Activity 2?
2. Create a square wave generator. The square wave generator has two different frequencies: 250 Hz, 125 Hz, and has two different duty cycles: 50%, 75%. Use two binary switches on the trainer board to control the frequency and duty cycle. (Note: the square wave generator can be achieved with only DELAY subroutine with a delay of 1ms).

IV. Questions

1. The frequency of the crystal used in the trainer board is _____.
The period of one clock cycle is _____.
The 8051 chip used in the trainer board is _____.
How many clocks are required to finish one machine cycle (Mazidi, p.84)
_____.
The duration of one machine cycle is _____.
2. Based on the answers to the previous question, fill in the following table (Find the machine cycles in Mazidi, p.85).

	MOV	DJNZ	LJMP	SJMP	NOP
Machine Cycles					
Delay (ms)					

3. Find the exact time delay of the following program

```

DELAY: MOV R2, #120
AGAIN: MOV R3, #250
HERE:  NOP
        NOP
        NOP
DJNZ:  R3, HERE
DJNZ:  R2, AGAIN
RET

```