

LAB 4 Servo Controller

NAME:

DUE DATE:

STUDENT ID:

POSSIBLE POINTS: 10

COURSE DATE & TIME:

OBJECTIVE:

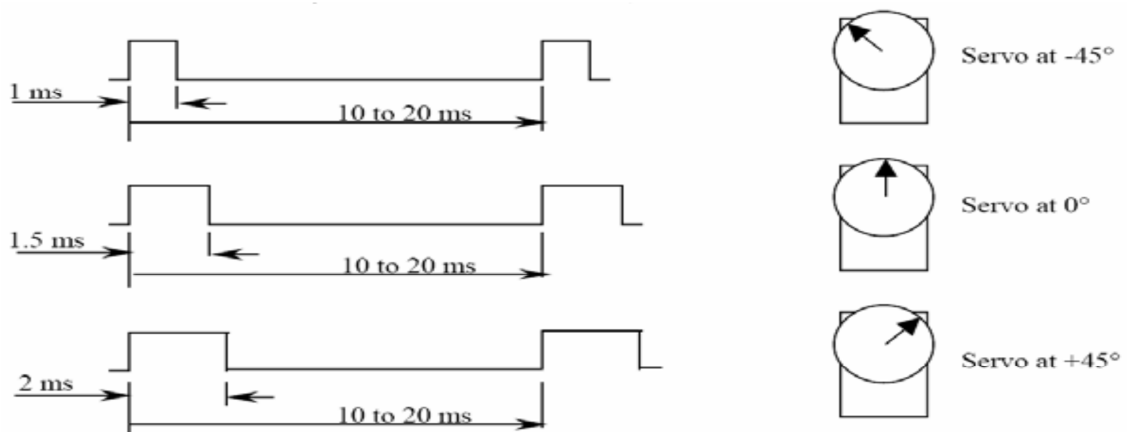
- To interface and drive a “Hobby” type 3wire Servo from the 8051.
- To program the 8051 to use one of the peripheral timers, which will generate an Interrupt that creates a positive timed pulse on one of the I/O Port Pins. The duration of time that the positive pulse stays high will determine the angle that the servo moves to.

OPERATION:

The program will take a binary input from a set of 8 switches on the 8051. The valid input will range from 0 to 255 decimal and will respectively drive the Servo from -45 degrees to positive 45degrees.

THEORY:

Driving the Servo to the desired angle will require generating a repeating positive pulsed signal on one of the I/O pins. The following diagram and respective timing should make this clear.



Although there are several ways to program a microcontroller to generate this pulse, the required method for this lab is as follows. An 8051 timer will be configured to generate a software interrupt every 10 to 20ms (it should be a fixed value within the acceptable range and is up to the programmer to decide). Inside this interrupt portion of code the first thing done will be setting a Port I/O Pin High, a delay loop will create a delay between 1ms and 2ms then the Port I/O Pin will be cleared. The switches being read will determine the delay value inside the

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interrupt.

The switches will be read from the "MAIN" loop, then that number will be modified by the arithmetic instructions to a value which can be used by the delay routine.

CONNECTIONS:

A Servo is a relatively easy device to interface with a microcontroller. There are 3 wires, typically black is ground, red is 5v, and white or yellow is the signal wire that will be driven by your Port I/O Pin.

MATERIALS:

You will have to provide your own Servo, I suggest the HS-311 found at any Hobby store. But you can use any that changes angle based from a Positive Pulse within a 10-20ms cycle. Hobby stores also sell a "digital" servo, these won't work and are much more expensive anyways. I can help any students that have difficulty getting this.

LAB WRITE-UP AND DELIVERABLES:

- The lab write-up will include this page as the cover sheet and the source code.
- A schematic of your specific implementation will be included. Your schematic will have to be done with Circuit Maker but cannot be hand-drawn. You must label all devices, values.
- 2 Screenshots/Pictures from an oscilloscope. These must show one entire period of the signal and the rising edge of the next repetition. A measurement of the start and end of the positive pulse must be clearly visible using the vertical cursor bars. One image should be of the shortest pulse (1ms) with a switch value of 0x00 and the 2nd image should be of the longest pulse (2ms) with a switch value of 0xFF.

DEMO AND GRADING:

When your project is ready, you will demonstrate the functionality to the instructor and hand in the write-up. Your demo will be graded on its ability to correctly resolve a desired angle from the value set on the switches. Also I will be looking for good coding techniques which will be discussed during the lab period. Code structure and flow of data in your programs become crucial with the use of interrupts.