AIM AND INTRODUCTION

Aim:

1. To interface 8 bit ADC 0804 IC with AT89S52 microcontroller.
2. Vary the input voltage and observe the equivalent digital bit pattern.
3. Interface the LM35 temperature sensor and measure the room temperature.

Introduction:

An analog to digital converter (ADC) converts an analog signal to digital form. An embedded system uses the ADC to collect information from external world (data acquisition system). The i/p signal is usually an analog voltage, and the o/p is a binary number. The ADC precision is the no. of distinguishable ADC inputs [(eg). 256 alternatives, 8 bits]. The ADC range is the maximum and minimum ADC i/p ((eg) 0 to +5 V). The ADC resolution is the smallest distinguishable change in i/p [(eg) 5V/255, which is about 19 mV]. The resolution is the change in input that causes the digital o/p to change by 1.

Range (volts) = Precision (alternatives) x Resolution (volts).

Resolution = Range / $2^n - 1$, where 'n' is the no. of bits in ADC.

INTRODUCTION –

A servo uses servo mechanism, which is a closed loop mechanism that uses position feedback to control the precise angular position of the shaft. Stepper Motors, which is an open loop system can also be used for precise angular control. But Servo Motors are preferred in angular motion applications such as robotic arm. Moreover controlling of servo motors are very simple, easy and needs no extra hardware like stepper motor. Usually hobby circuit servo motors have three wires. Two of them are red and black which is used to give power to the motor and the third wire is used to provide control signal for angular position. It uses Pulse Width Modulated (PWM) waves as control signals. The angle of rotation is determined by the width of the pulse at the control pin. The servo motor used here is having angle of rotation from 0 to 180 degrees. We can control the exact angular position by varying the pulse between 1ms to 2ms. Before using this in your application, please refer the data sheet of your servo for angle and pulse width informations.

THEORY –

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through servo mechanism.

It consists of three parts:

1. Controlled device
2. Output sensor
3. Feedback system

It is a closed loop system where it uses positive feedback system to control motion and final position of the shaft. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal.

Here reference input signal is compared to reference output signal and the third signal is produces by feedback system. And this third signal acts as input signal to control device. This signal is present as long as feedback signal is generated or there is difference between reference input signal and reference output signal. So the main task of servomechanism is to maintain output of a system at desired value at presence of noises.

A servo consists of a Motor (DC or AC), a potentiometer, gear assembly and a controlling circuit. First of all we use gear assembly to reduce RPM and to increase torque of motor. Say at initial position of servo motor shaft, the position of the potentiometer knob is such that there is no electrical signal generated at the output port of the potentiometer. Now an electrical signal is given to another input terminal of the error detector amplifier. Now difference between these two signals, one comes from potentiometer and another comes from other source, will be processed in feedback mechanism and output will be provided in term of error signal. This error signal acts as the input for motor and motor starts rotating. Now motor shaft is connected with potentiometer and as motor rotates so the potentiometer and it will generate a signal. So as the potentiometer's angular position changes, its output feedback signal changes. After sometime the position of potentiometer reaches at a position that the output of potentiometer is same as external signal provided. At this condition, there will be no output signal from the amplifier to the motor input as there is no difference between external applied signal and the signal generated at potentiometer, and in this situation motor stops rotating.

All motors have three wires coming out of them. Out of which two will be used for Supply (positive and negative) and one will be used for the signal that is to be sent from the MCU.

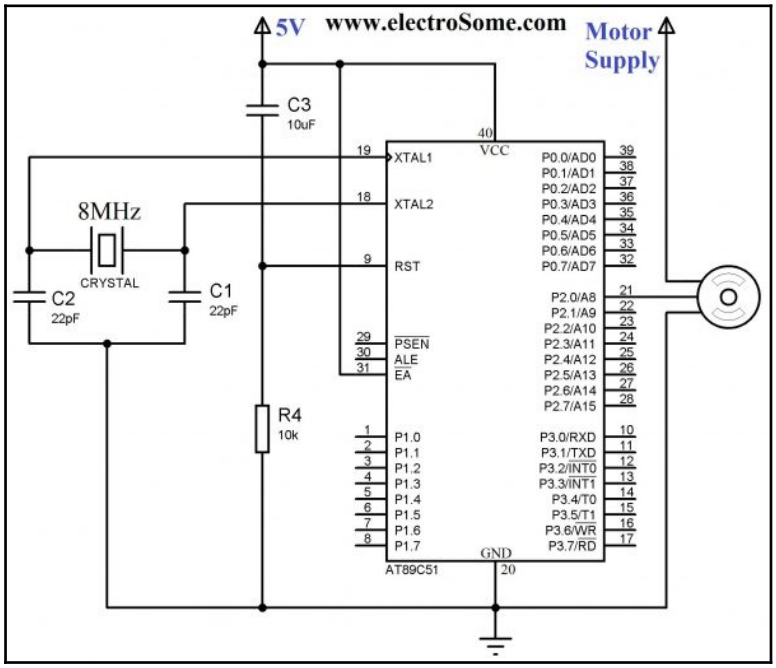
Servo motor is controlled by PWM (Pulse with Modulation) which is provided by the control wires. There is a minimum pulse, a maximum pulse and a repetition rate. Servo motor can turn 90 degree from either direction form its neutral position. The servo motor expects to see a pulse every 20 milliseconds (ms) and the length of the pulse will determine how far the motor turns. For example, a 1.5ms pulse will make the motor turn to the 90° position, such as if pulse is shorter than 1.5ms shaft moves to 0° and if it is longer than 1.5ms than it will turn the servo to 180°.

Servo motor works on PWM (Pulse width modulation) principle, means its angle of rotation is controlled by the duration of applied pulse to its Control PIN. Basically servo motor is made up of DC motor which is controlled by a variable resistor (potentiometer) and some gears. High speed force of DC motor is converted into torque by Gears. We know that WORK= FORCE X DISTANCE, in DC motor Force is less and distance (speed) is high and in Servo, force is High and distance is less. Potentiometer is connected to the output shaft of the Servo, to calculate the angle and stop the DC motor on required angle.

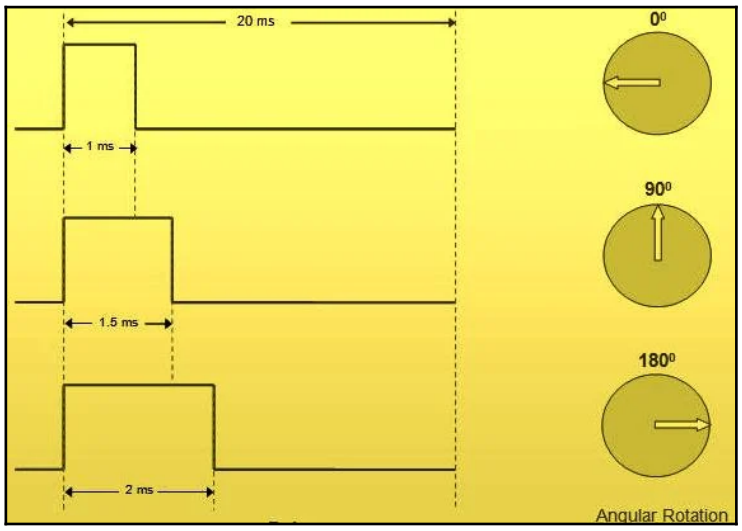
Servo motor can be rotated from 0 to 180 degree, but it can go up to 210 degree, depending on the manufacturing. This degree of rotation can be controlled by applying the Electrical Pulse of proper width, to its Control pin. Servo checks the pulse in every 20 milliseconds. Pulse of 1 ms (1 millisecond) width can rotate servo to 0 degree, 1.5ms can rotate to 90 degree (neutral position) and 2 ms pulse can rotate it to 180 degree.

All servo motors work directly with your +5V supply rails but we have to be careful on the amount of current the motor would consume, if you are planning to use more than two servo motors a proper servo shield should be designed.

CIRCUIT DIAGRAM –



OUTPUT GRAPH –



CODE –

```
#include<reg52.h>
#include<stdio.h>
#include <intrins.h>

sbit motor_pin = P2^0;
void Delay(unsigned int);
void Delay_servo(unsigned int);
void main()
{
  motor_pin = 0;
  do
  {
    //Turn to 0 degree
    motor_pin = 1;
    Delay_servo(50);
    motor_pin = 0;

    Delay(1000);

    //Turn to 90 degree
    motor_pin=1;
    Delay_servo(82);
    motor_pin=0;

    Delay(1000);
    //Turn to 180 degree
    motor_pin=1;
    Delay_servo(110);
    motor_pin=0;

    Delay(1000);
  }while(1);
}

void Delay(unsigned int ms)
{
  unsigned long int us = ms*1000;
  while(us--)
  {
    _nop_();
  }
}

void Delay_servo(unsigned int us)
{
  while(us--)
  {
    _nop_();
  }
}
```