# Week 11 Lab Report

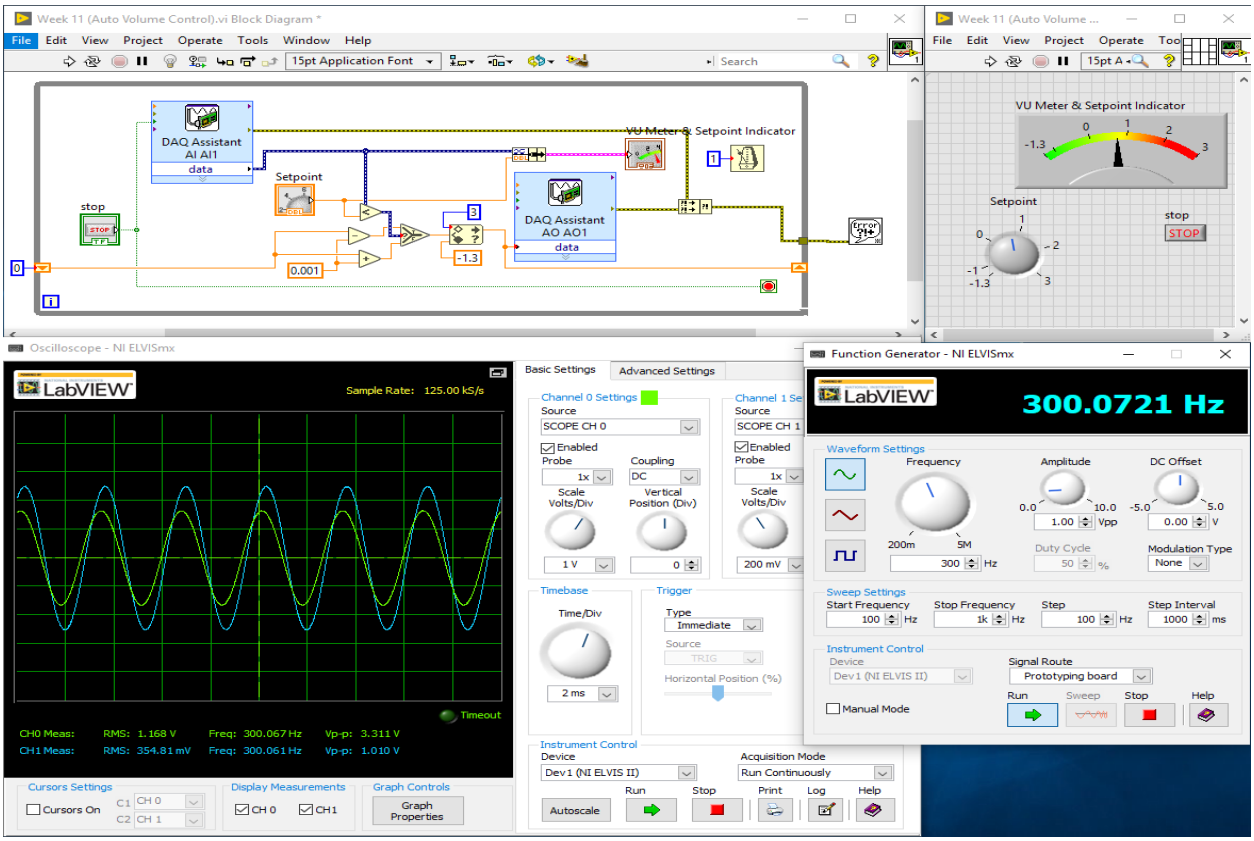
**Objective**

To implement and test the automatic volume control for audio amplifier system using LabVIEW/ELVIS with the step function as shown:

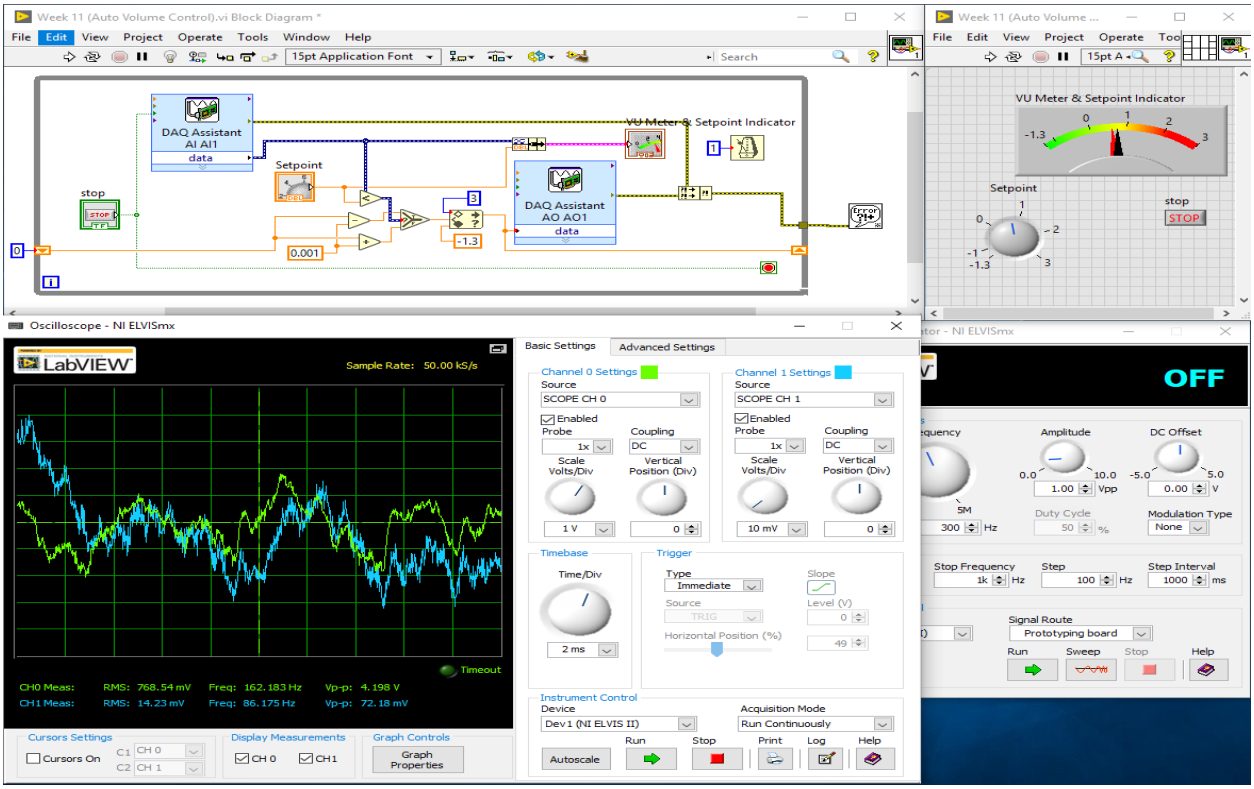
Step-Up-Down Controller: $u(n) = \{ u(n-1) - \Delta, e(n) > 0, z(n) < r0$
$\{ u(n-1) + \Delta, e(n) < 0, z(n) > r0$

- $e(n) = r0 - z(n)$
- where Δ is the controller parameter variable (step size),
- u(n) is the actuator control voltage for VCA,
- z(n) is the VU meter envelope detector output sensor value $r0$ is the set point value.

**Auto Volume Control Block Diagram with Function Generator & Oscilloscope**




(Figure 1)




(Figure 2)

Waveform

The Figure 1 is shows the Output Gain of the Audio Amplifier System. We tested the system on real-application by playing music on Youtube with Input connected to the computer system. It can be shown at Figure 2 that the Output signal is trying to follow the Input signal with slight delay. The sound of the music is acceptable as the noise level is small.

Step-Up-Down Controller

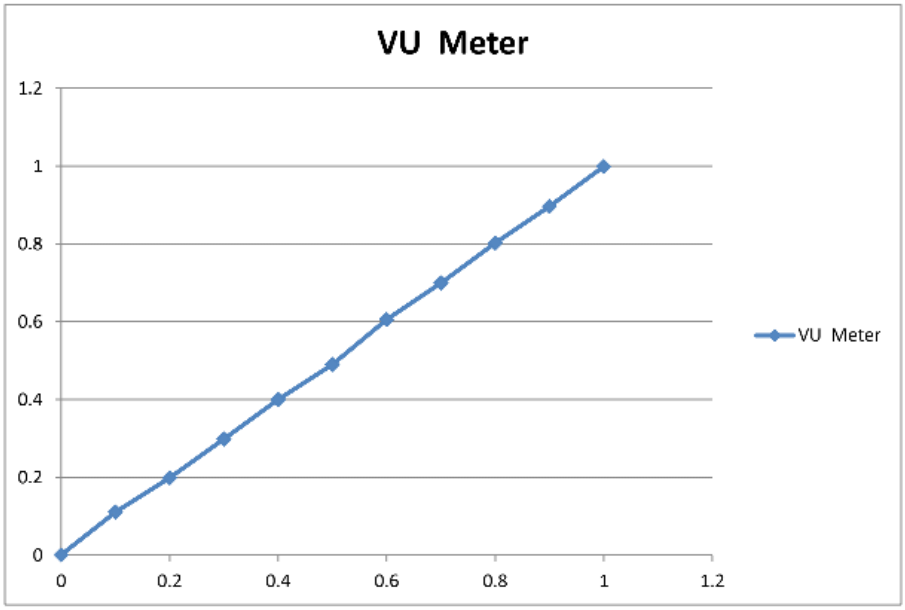
The higher the step size, the faster the red needle reaches the black needle (Set point). On the other hand the lower the step size the slower the red needles reaches the black needle.

Due to the comparison of the set point and the Input signal, the step function will increase the volume lesser than the setpoint and decrease the volume greater than the set point at the rate of input step function until it reaches the set point.

**For each set point Ro value, input different audio signal levels. Listen to the speaker output. Record and discuss your observations:**

| Setpoint | VU Meter |
|---|---|
| 0 | 0.0009 |
| 0.1 | 0.111 |
| 0.2 | 0.1988 |
| 0.3 | 0.2985 |
| 0.4 | 0.3999 |
| 0.5 | 0.4899 |
| 0.6 | 0.6053 |
| 0.7 | 0.6998 |
| 0.8 | 0.8025 |
| 0.9 | 0.8963 |
| 1 | 0.9989 |

(Figure 3)




(Figure 4)

The VU meter reading is increasing linearly with the Setpoint.

**Open Ended Questions**

Does the chip on your circuit heat up during operation? If so, please explain what causes this phenomenon and suggest possible solutions to solve this problem.

The chip does heat up to a small extent. It is very normal for the IC chip to heat up because power is generated into the circuit to allow it to operate. As we did not connect the +15V, -15V, GROUND wrongly, we did not experience heat at high temperature. Since we limit our Input Signal to -1.3V to 3V same as the specification of the IC chip, it does not heat up so much.

Measures to reduce the heat:

1) Reducing the clock speed.
2) Reduce the gate capacitance by making smaller transistors.
3) Reduce the voltage used.
4) Turn off the unused parts of the chips.