

Audio Amp Range

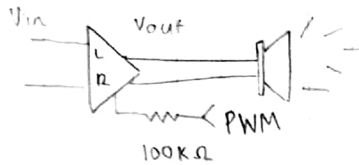
100 - 200 mW RMS = 0.1 - 0.2 W

Speaker: 8Ω

$$P = \frac{V^2}{R} \Rightarrow \sqrt{P \cdot R} = V$$

$$V_{RMS, MAX} = 1.2649 \text{ V}$$

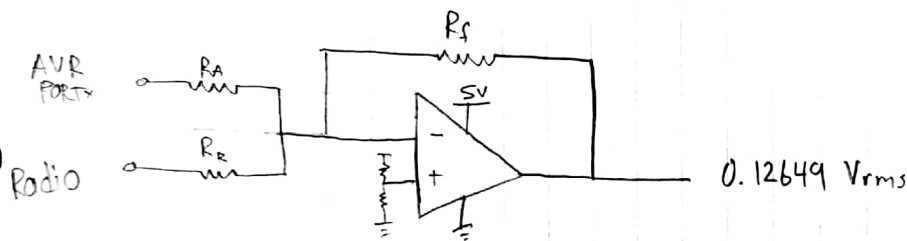
$$V_{RMS, MIN} = 0.8944 \text{ V}$$



Op AMP Max Gain = 20 dB

$$20 \log_{10} \left(\frac{V_{out}}{V_{in}} \right) = 20 \text{ dB} \quad \text{So,} \quad \frac{V_{out}}{V_{in}} = 10$$

$$V_{in} = \frac{V_{out}}{10} = \frac{1.2649 \text{ V}_{RMS}}{10} = 0.12649 \text{ V}_{RMS}$$



$$-V_{out} = R_f \left(\frac{V_1}{R_1} + \frac{V_2}{R_2} \right)$$

Conversions

AVR: $V_{p-p} = 5$ $V_{RMS} = \frac{V_{p-p}}{2\sqrt{2}} = 1.7678 \text{ V}_{RMS}$

Radio: $V_{p-p} = 75 \text{ mV}_{pp}$ $V_{RMS} = \frac{75 \cdot 10^{-3}}{2\sqrt{2}} = 26.5165 \cdot 10^{-3} \text{ V}_{RMS}$

Case 1:

- $V_A = 0$
- $V_B = 26.5165 \cdot 10^{-3} \text{ V}_{RMS}$
- $V_o = 0.12649 \text{ V}_{RMS}$

$$0.12649 = R_f \left(\frac{26.5165 \cdot 10^{-3}}{R_2} \right)$$

$$\Rightarrow 4.77024 = \frac{R_f}{R_2}$$

$$R_2 \approx 2.1 \text{ K}\Omega$$

$$R_f = 10 \text{ K}\Omega$$

Case 2:

- $V_A = 1.7678 \text{ V}_{RMS}$
- $V_B = 0$
- $V_o = 0.12649 \text{ V}_{RMS}$

$$0.12649 = R_f \left(\frac{1.7678 \text{ V}_{RMS}}{R_1} \right)$$

$$\Rightarrow 0.071552 = \frac{R_f}{R_1}$$

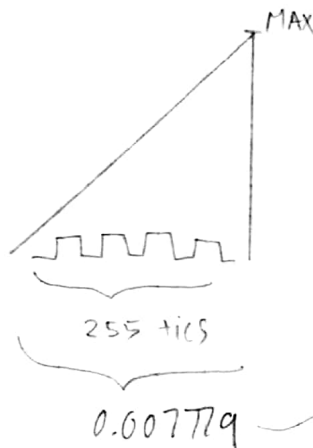
$$R_1 \approx 140 \text{ K}\Omega$$

Other Lab 1 Calculations

Real-time clock:

$$\text{Delay}_{\text{normal}} = \frac{(\text{MAX} - 1 - \text{Value}) \text{Prescaler}}{\text{CLK} \pm 10}$$

$$\text{Period} = 30.51 \cdot 10^{-3}$$



each tick has a period of 30.5 μsec

$$255 \text{ of them} = 0.007779$$

$$T_0 \cdot C = 1 \text{ second}$$

* Where C is a constant

$$C = \frac{1}{0.007779} = \boxed{128.549 = C}$$

Alarm tone:

* Using CTC normal mode

$$f_{\text{outA}} = \frac{f_{\text{clk}}}{2N(1 + \text{OCR}_{nA})} = \frac{f_{\text{clk}}}{2N + 2N\text{OCR}_{nA}}$$

$$2N + 2N \cdot \text{OCR}_{nA} = \frac{f_{\text{clk}}}{f_{\text{outA}}} - 2N$$

$$\text{OCR}_{nA} = \frac{f_{\text{clk}}}{2N f_{\text{outA}}} - 1$$

* w/ no prescaler

$$\text{OCR}_{nA} = \frac{16 \text{ M}}{2(2000)} - 1$$

OCR_{nA} must equal to 3999 for
a tone w/ freq. 2000 Hz

Lab 4 User Interface

Check to see if any button is pressed

Button # 7 allows us to change time

Button # 6 lets us set the alarm time.

Button # 5 arms the alarm (activate/disable)

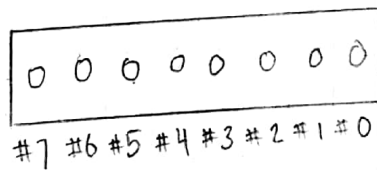
Button # 4 snoozes alarm (10 sec. duration)

Button # 3 Increase Volume

Button # 2 decrease Volume

} reserved
for
future
lab

Button Board layout

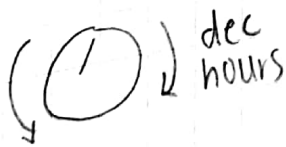


*Feel free to use description to determine each function

Encoders

*Note: In this lab they are used to change clock and alarm time.

Inc.
hours



Inc.
mins.

