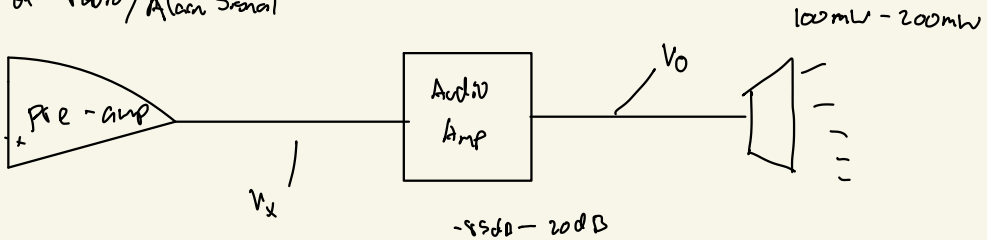
Goal:

Aiming for 100-200mW Rms (8Ω) of audio at speakers

Sum of radio/Alarm Signal



$P = IV$

$P = \frac{V_{rms}^2}{R}$

$V_{rms} = \sqrt{PR}$

$= \sqrt{(200 \cdot 10^{-3} W)(8\Omega)}$

$V_O = (1.26V)(2\sqrt{2}) = 3.56V$ pk-pk

Configuration:

SE/BTL → drive 1

20dB

$dB = 20\log_{10}\left[\frac{V_O}{V_{in}}\right]$ - Voltage/Current ratio

$\frac{dB}{20} = \log_{10}\left[\frac{V_O}{V_{in}}\right]$

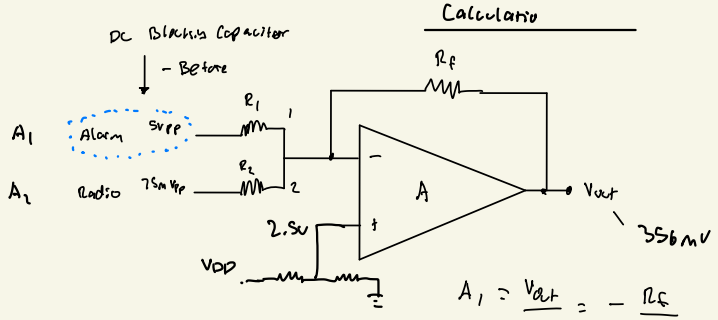
$10^{\frac{dB}{20}} = \frac{V_O}{V_{in}}$

$V_{in} = \frac{V_O}{10^{dB/20}}$ $dB = 20$

$V_{in} = \frac{3.56V}{10^{20/20}} = .356V$

$V_L = 356$ mV peak-peak

Calculations



Based on kit:

$R_f = 220\,\Omega$

Choose 220 Ω for R_f

$$A_1 = \frac{V_{out}}{V_{in}} = -\frac{R_f}{R_1}$$

Need to have 2.5 V at positive of the Amplifier to keep the signal at 2.5V so it does not Clip.

$$\frac{.356}{5v} = \frac{R_f}{R_1}$$

$$.07152 = \frac{R_f}{R_1}$$

$$R_1 = \frac{220}{.07152} = 3.1k\Omega$$

$$A_2 = \frac{V_{out}}{V_{in}} = \frac{.356\,V}{.075\,V_{pp}} = 4.74$$

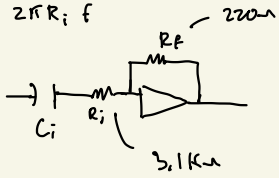
$$A_2 = \frac{-R_f}{R_2}$$

$$R_2 = \frac{220}{A_2}$$

$R_2 = 46.34\,\Omega$

input capacitor - high pass

$$C_i = \frac{1}{2\pi R_i f}$$



Lowest musical note is 16.32 Hz

we want to be able to account for all musical notes.

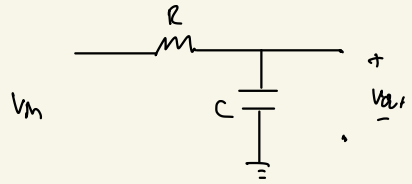
The kit has 4.7 μF capacitor

$C = 4.7\mu F$

$$f_c = \frac{1}{2\pi R_C} = \frac{1}{2\pi(3.1k\Omega)(4.7\mu F)} = 11\,Hz$$

Anything below 11 Hz will not go through the high pass filter. We want to block DC voltage so after pre-amp output does not get saturated.

Volume — PWM Calculation



$$X_C = \frac{1}{2\pi f C}$$

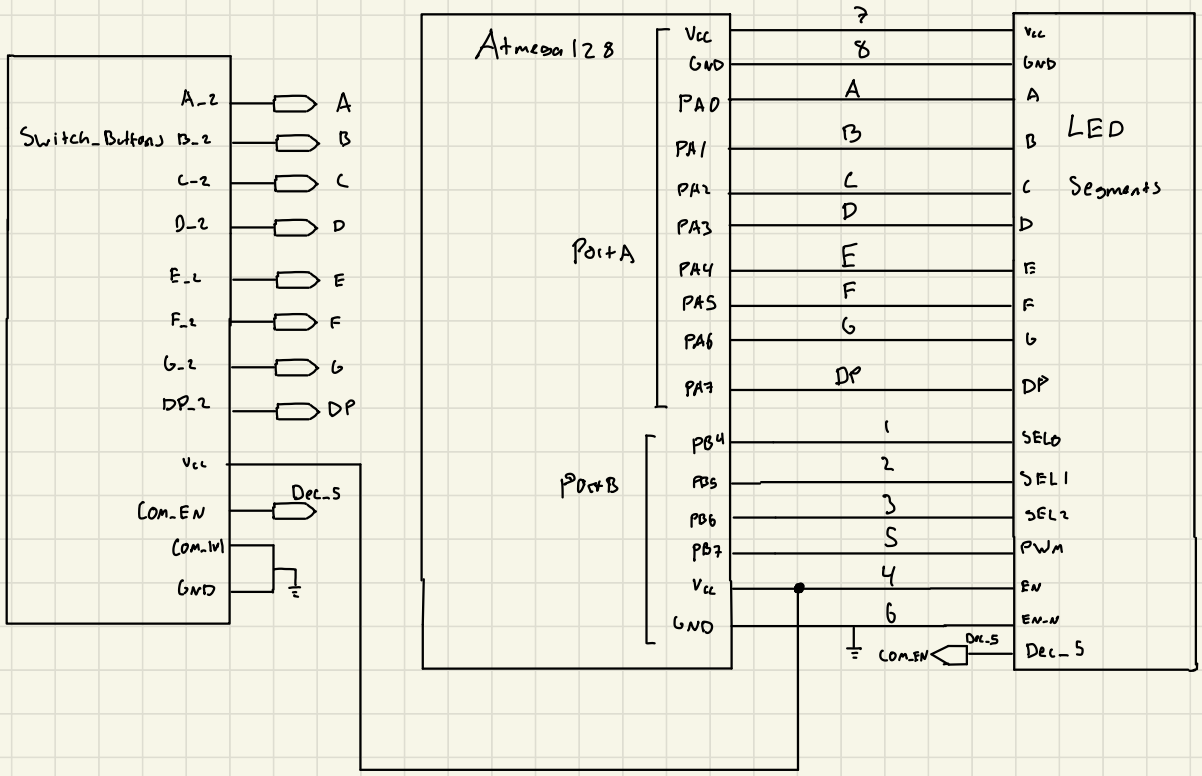
$C = .1\mu F$

$$V_{out} = V_{in} \frac{X_C}{\sqrt{R^2 + X_C^2}}$$

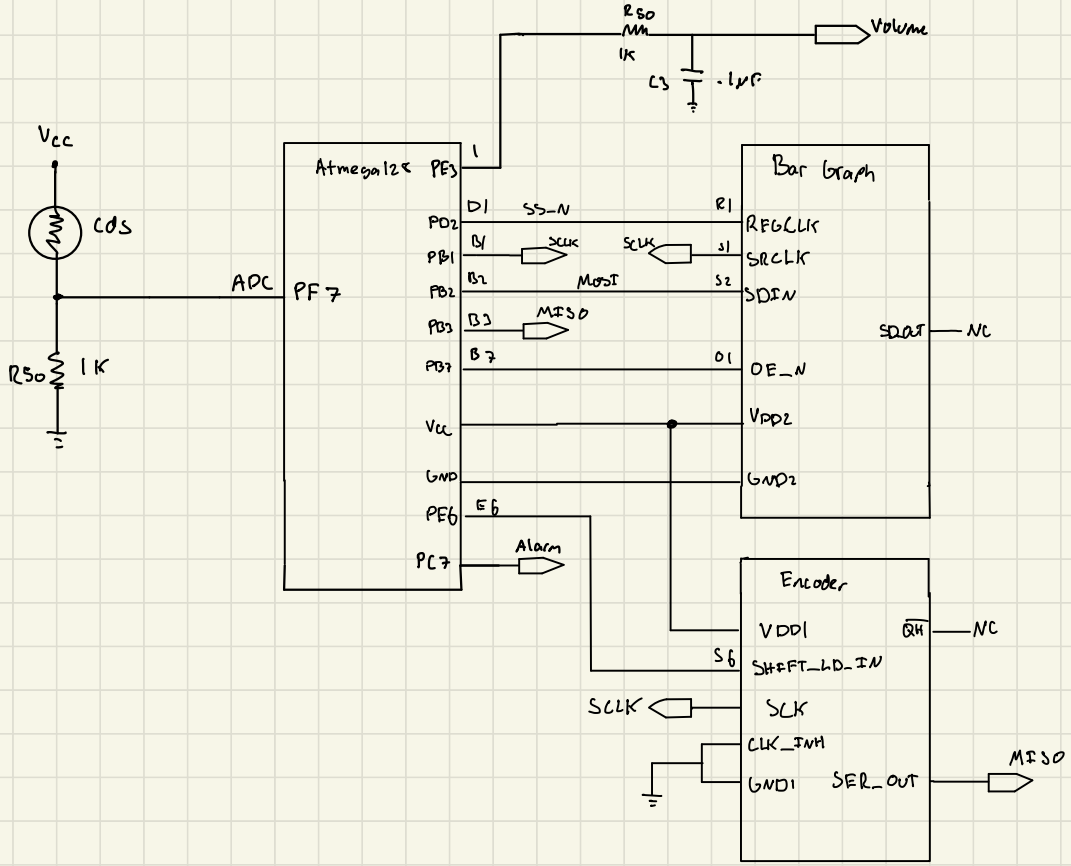
Based on kit chosen, $R = 1k\Omega$ $C = .1\mu F$

$$f_c = \frac{1}{2\pi RC} = \frac{1}{2\pi (1k\Omega)(.1\mu F)} \simeq 1591\ Hz$$

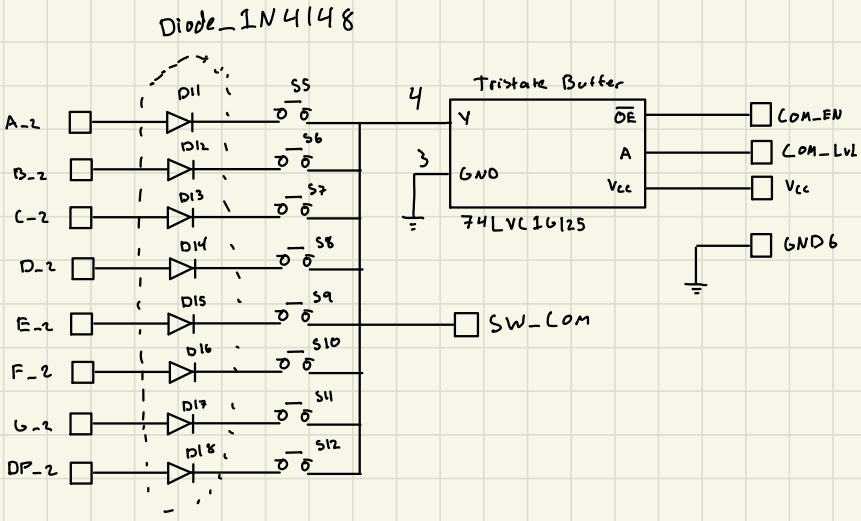
We don't want to low of a cut off frequency or it'll take a long time for the output voltage to reach the desired DAC voltage.



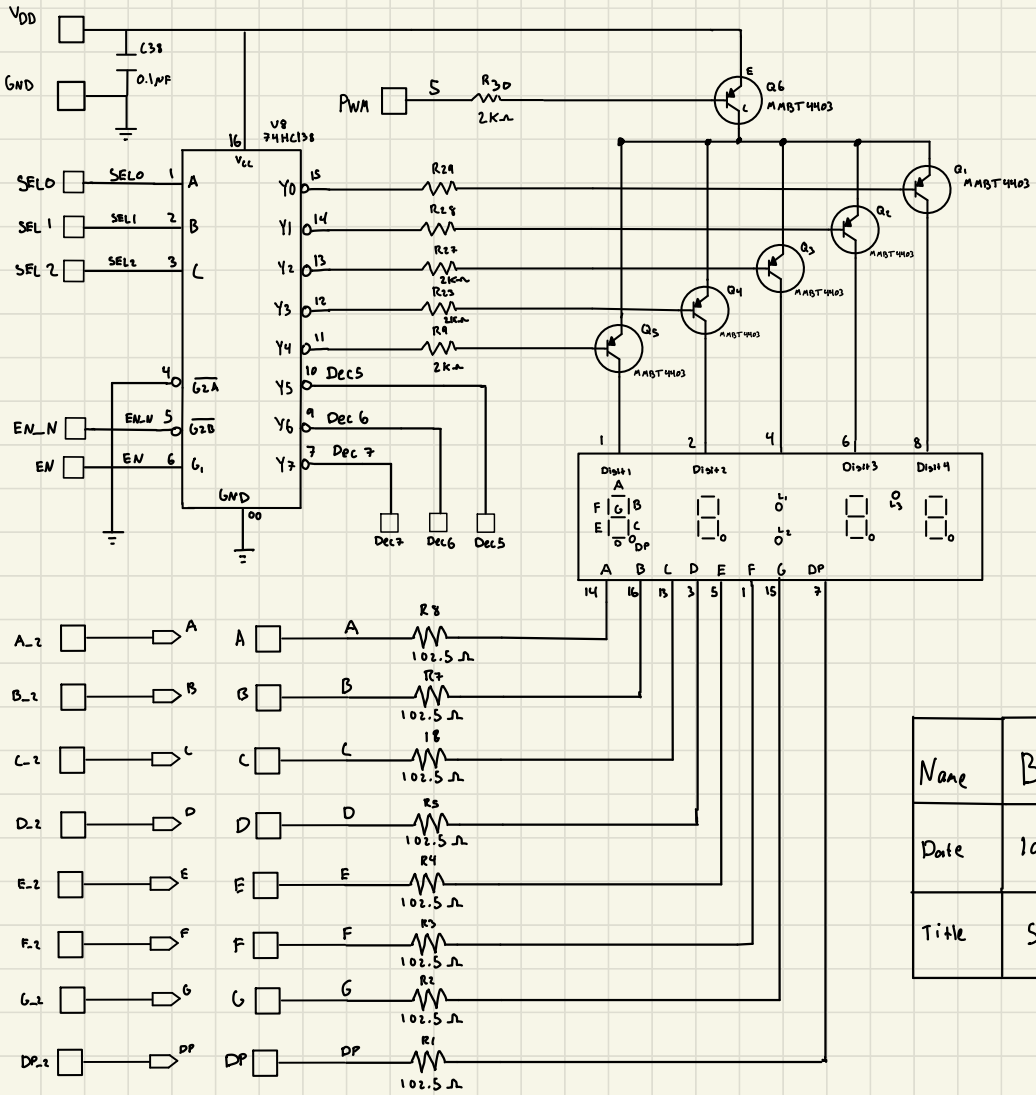
Name	Benson Ton
Date	10/30/2021
Title	Top Level



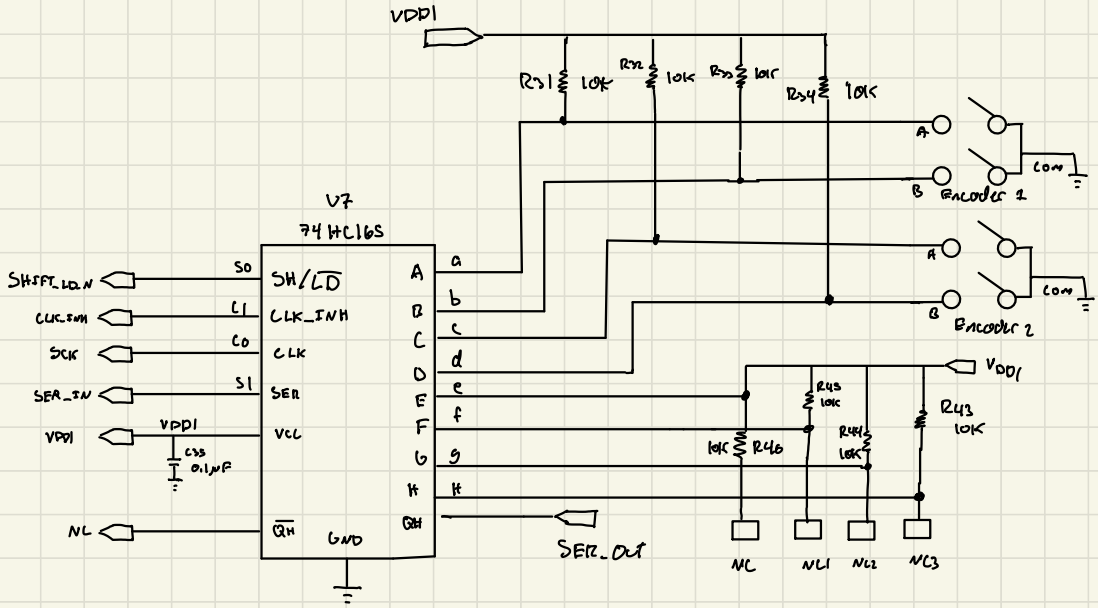
Name	Benson Ton
Date	11/16/2021
Title	Top level with Bargraph, encoders, cds cell



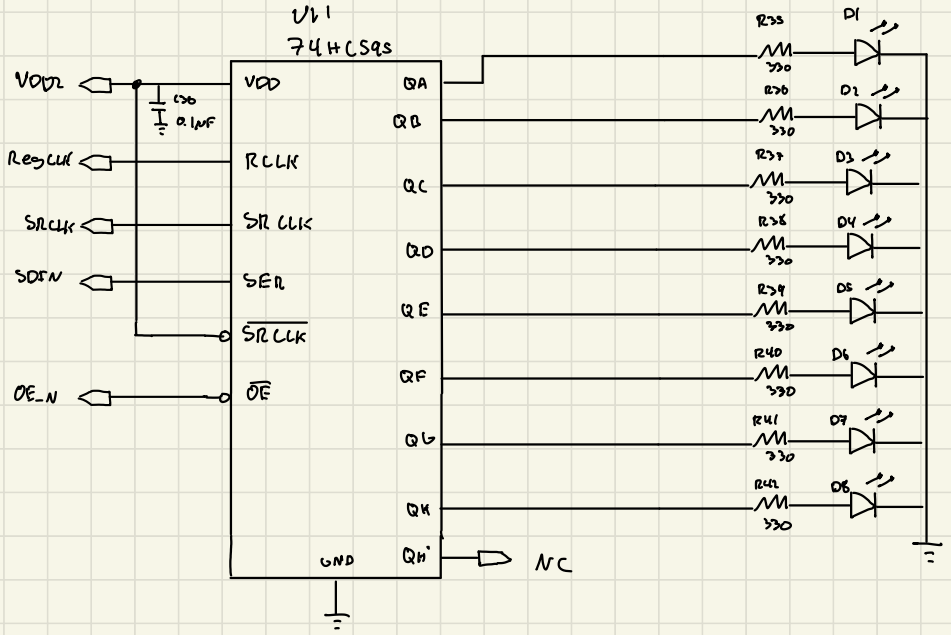
Name	Benson Ton
Date	10/10/2021
Title	Switch Board



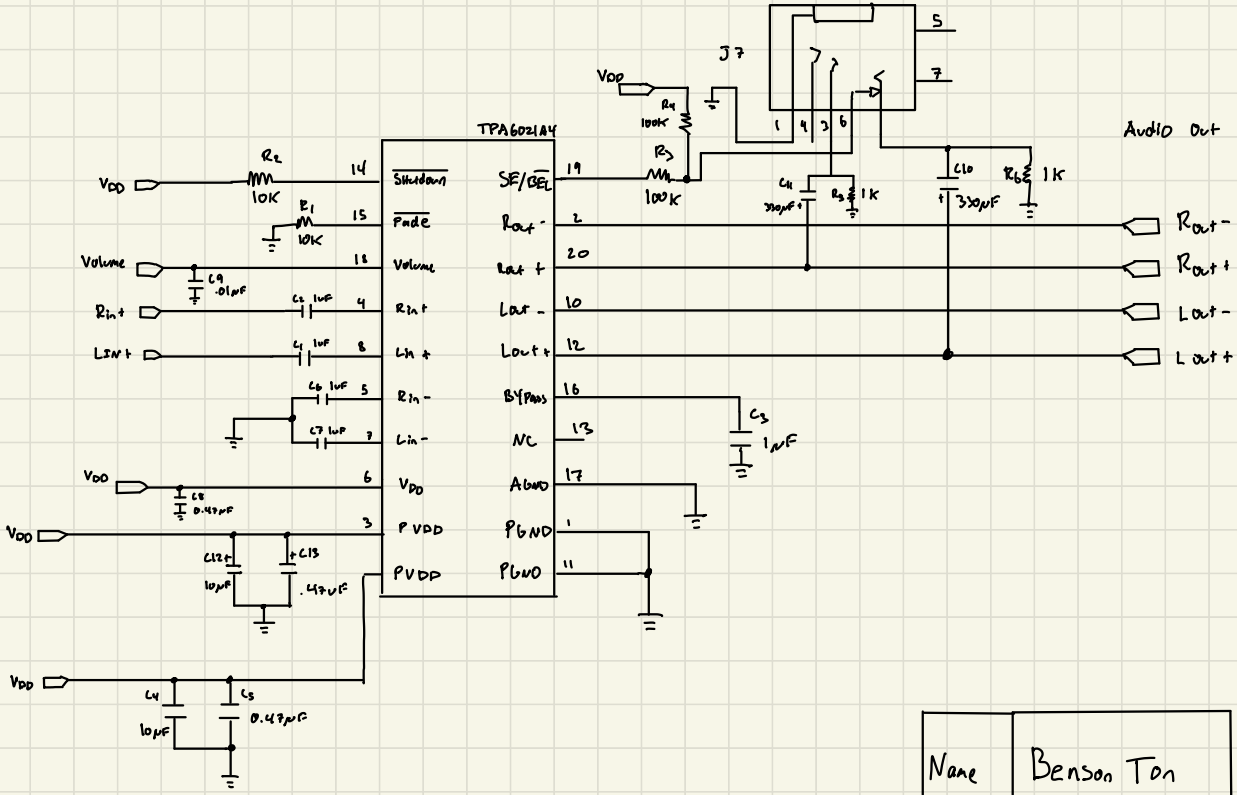
Name	Benson Tan
Date	10/10/2021
Title	Segments



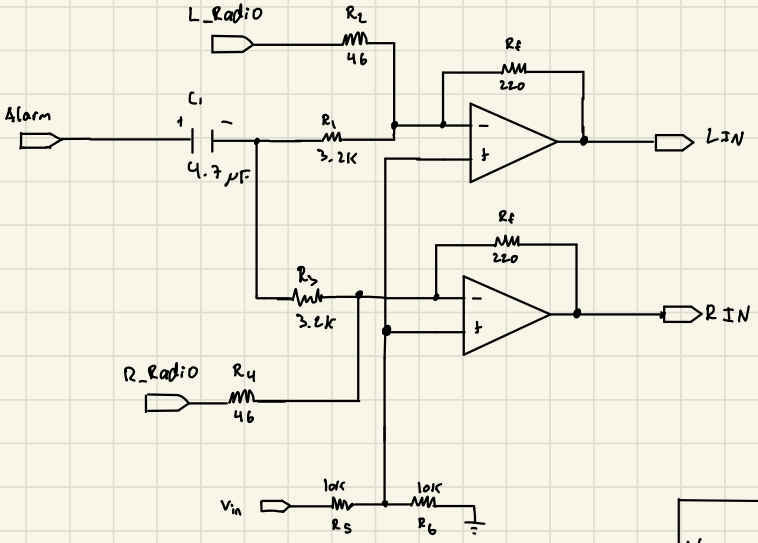
Name	Benson Ton
Date	10/30/2021
Title	Encoders



Name	Benson Ton
Date	10/30/2021
Title	Bar graph



Name	Benson Ton
Date	11/16/2021
Title	Audio Amp



Name	Benson Ton
Date	11/14/2021
Title	pre-OP-amp