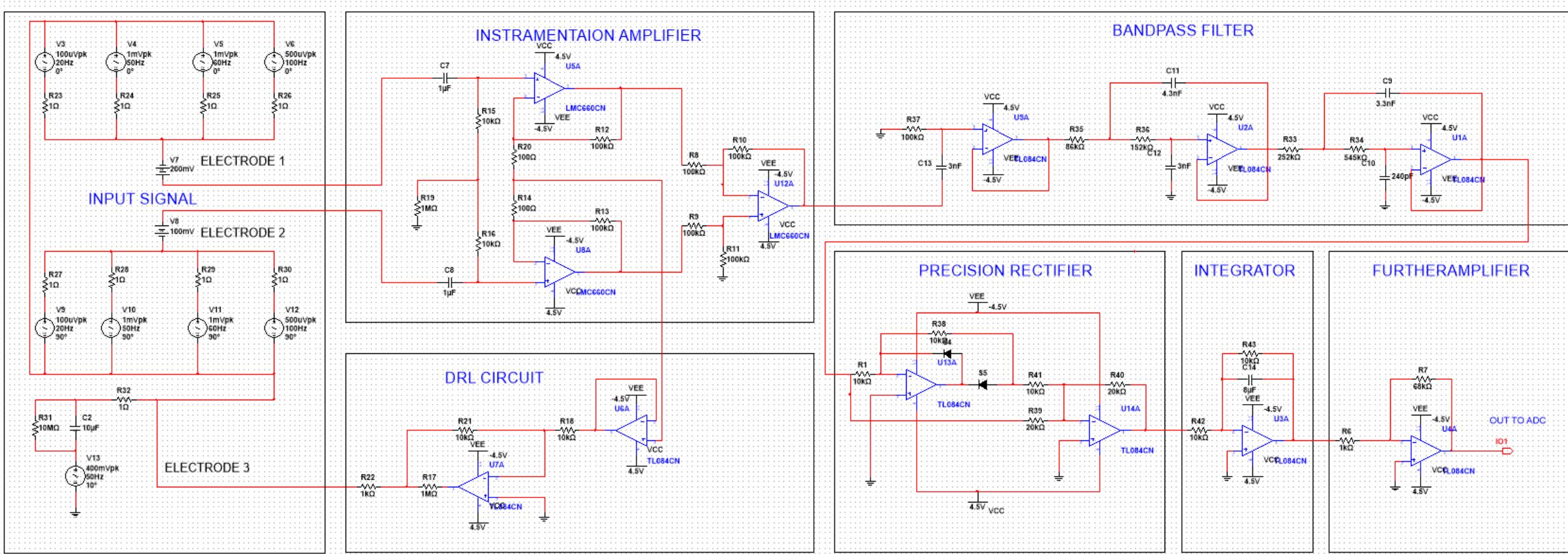


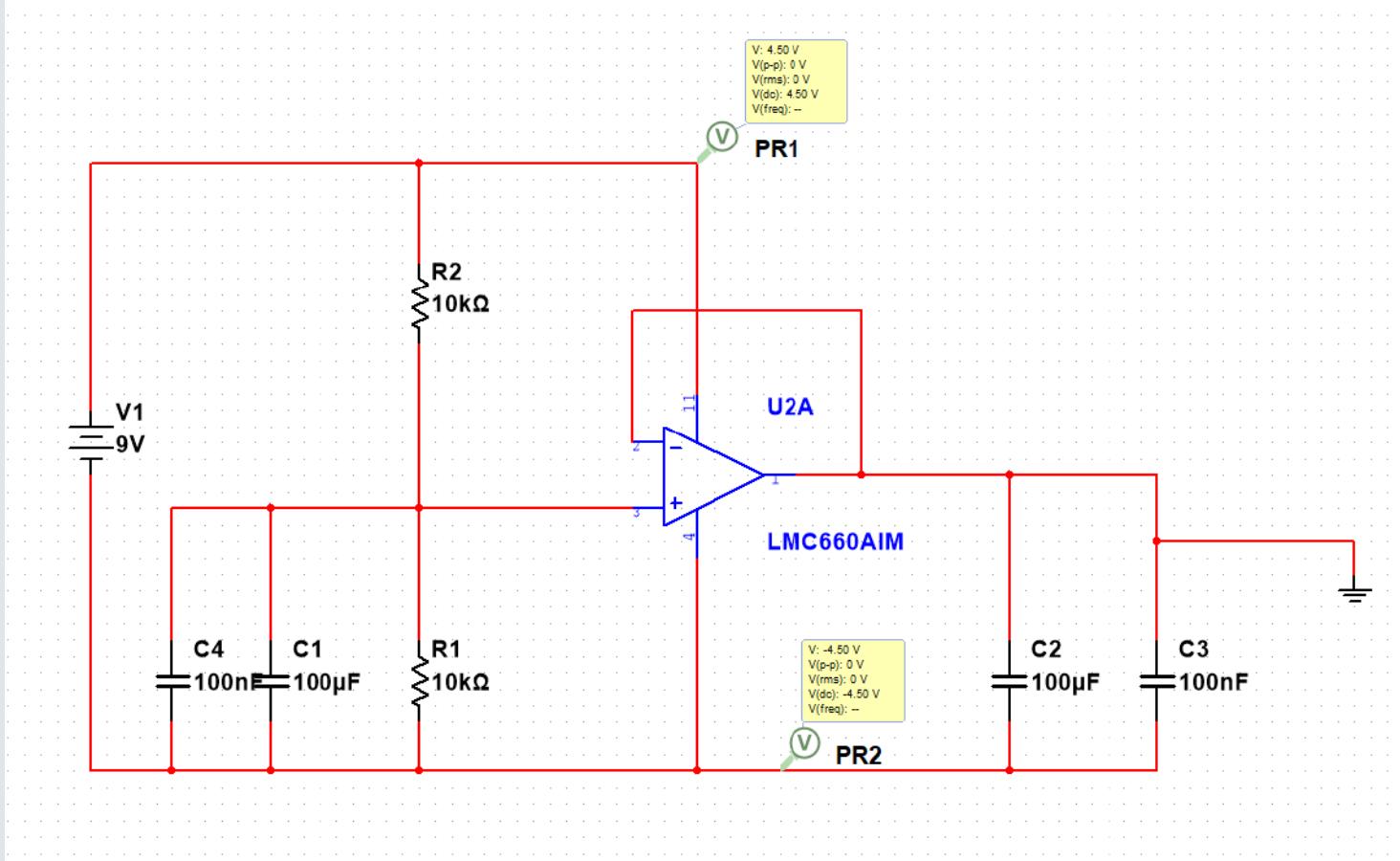
Contents

- Introduction
- Gantt chart of timeline
- Block diagram
- System overview
- Circuits and simulations of analog part
- Output
- Power calculation
- Components
- Cost evaluation

System overview

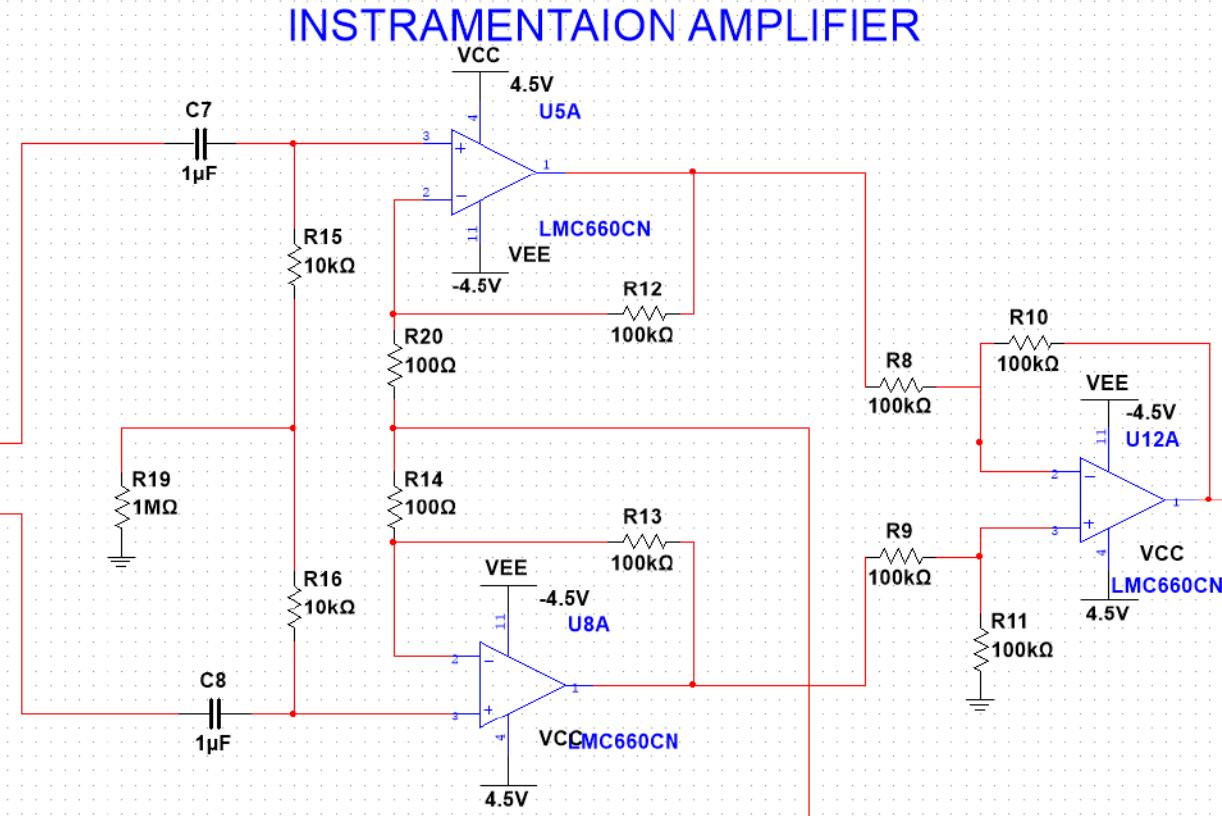


Potential divider



The function of this module is to convert the 9V voltage input of the battery into the required voltages of 4,5V and -4.5V.

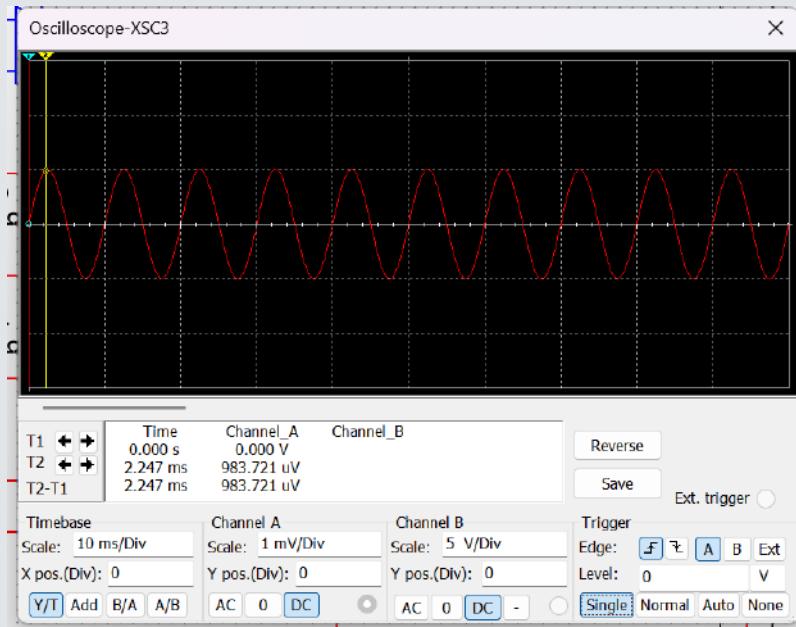
Pre-amplification



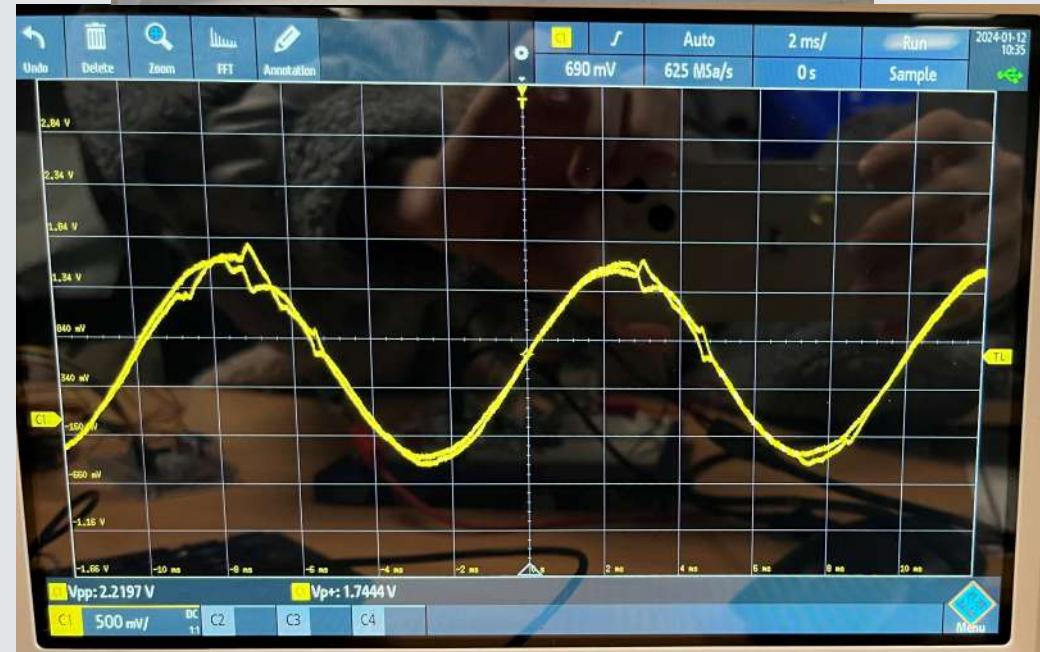
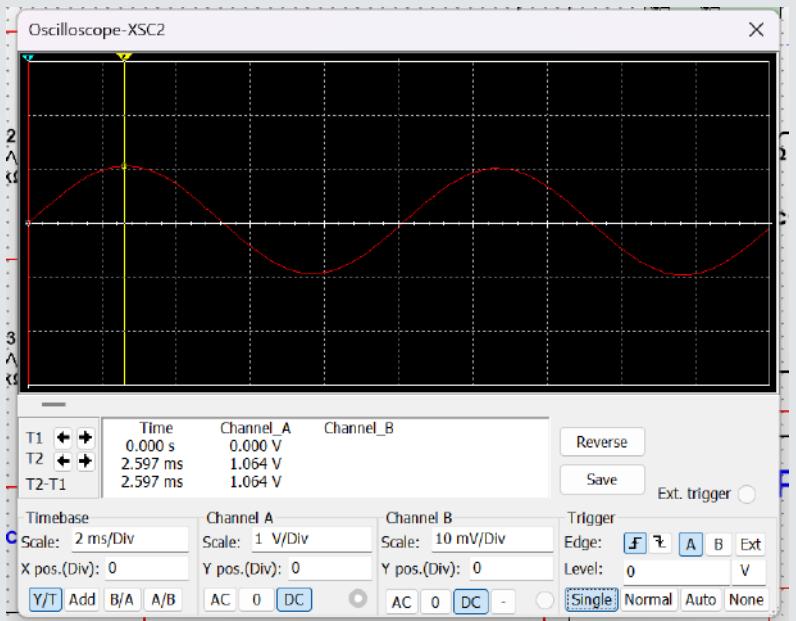
- Gain: about 1001V/v
- Two-non inverting amplifier to provide high input impedance.
- A difference amplifier, which provide low output impedance and high CMRR.
- Two capacitors to block DC
- LMC660CN provide high input impedance

Pre-amplification simulation

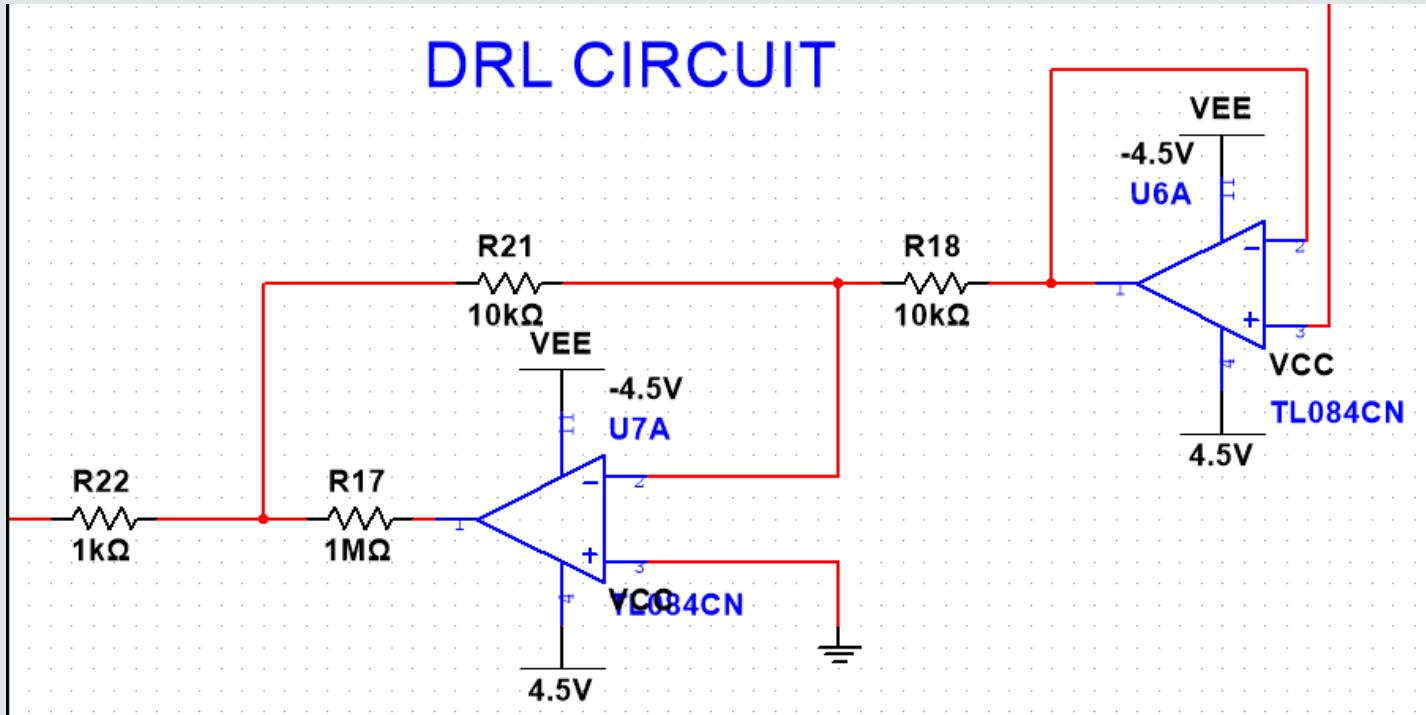
input



output

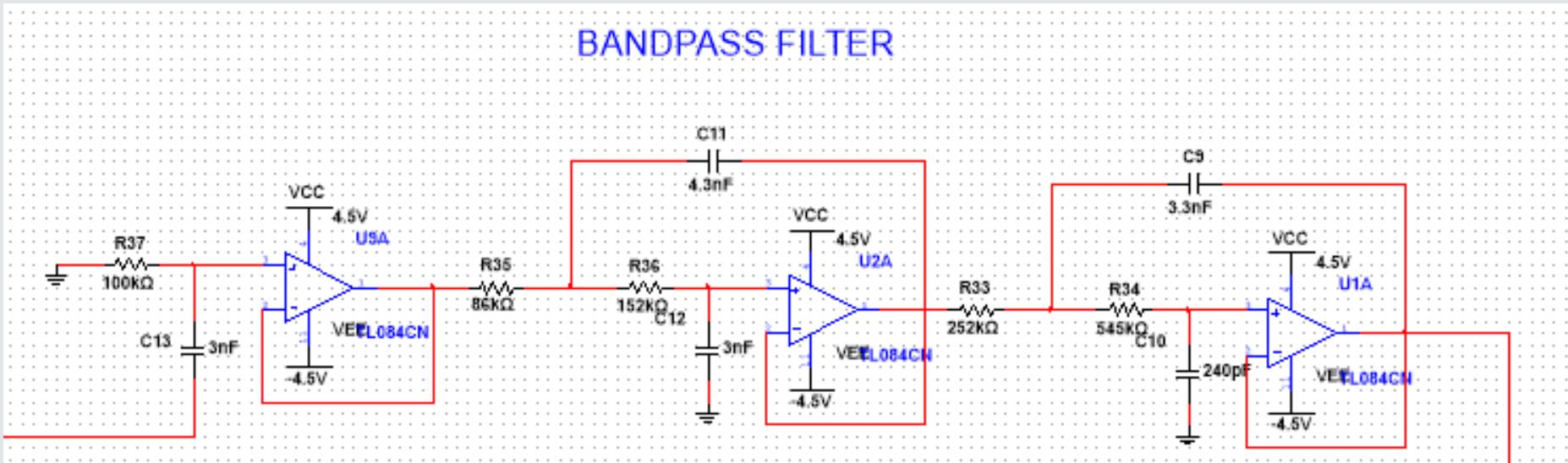


DRL circuit



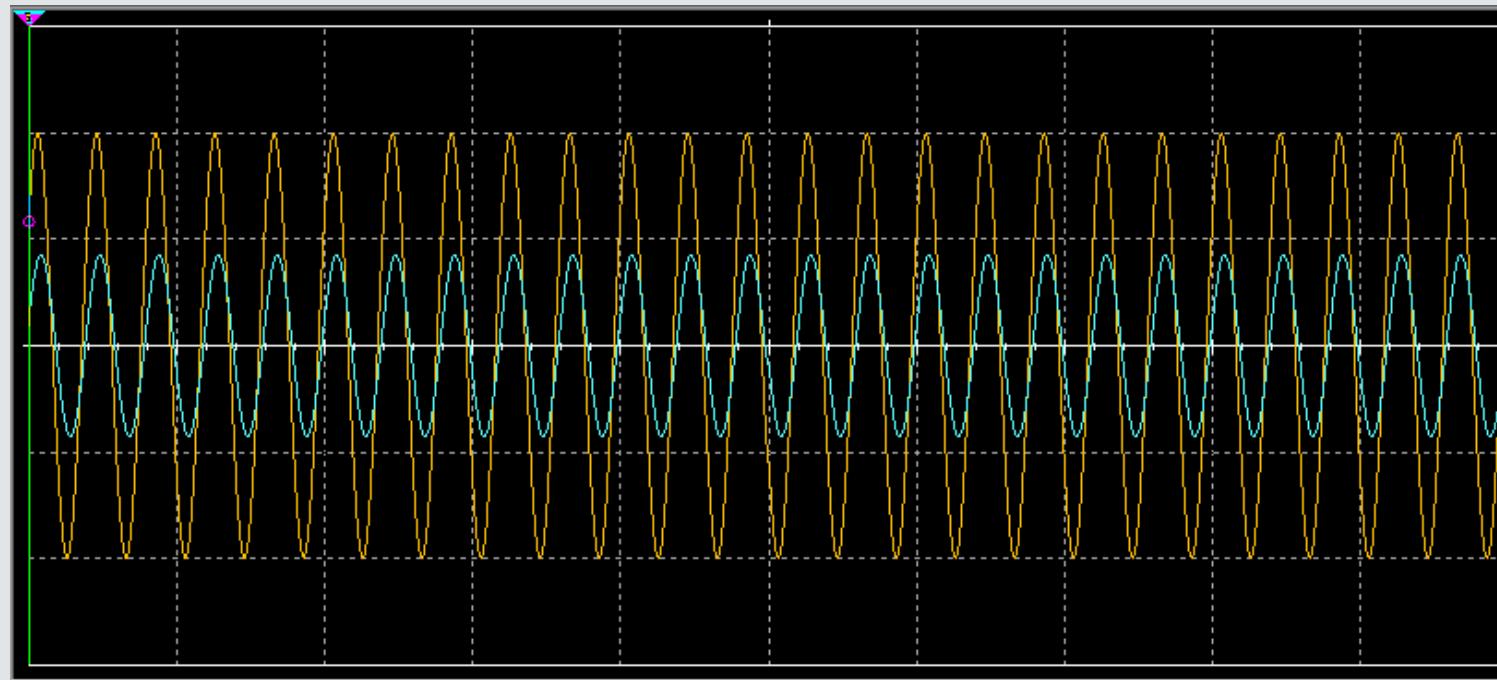
- Reduce interference due to common-mode voltage
- Provide a stable reference point

Filter

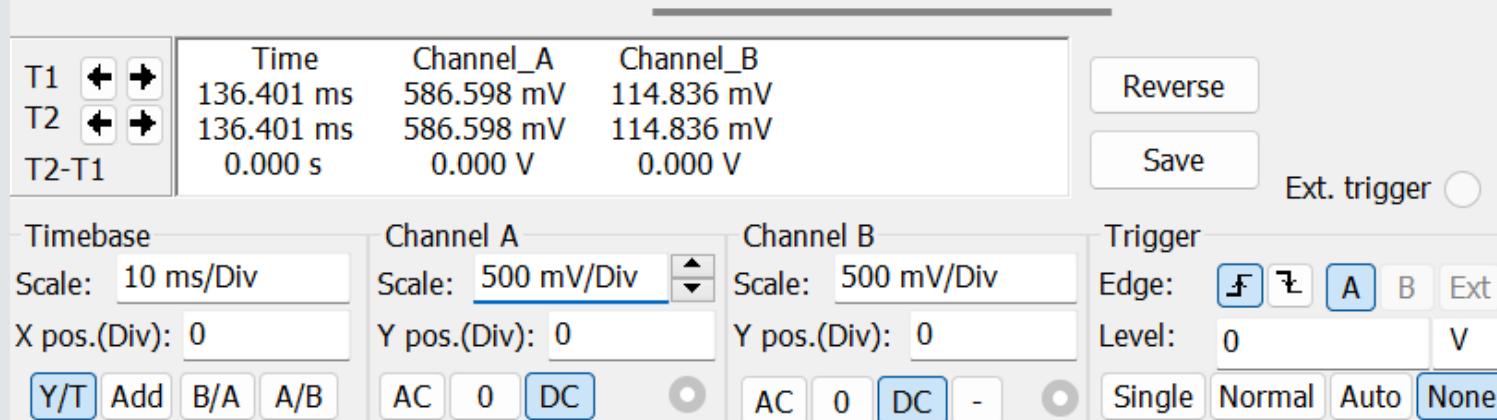


This section is designed to filter the frequency of the signal, realizing that only signals in the 10Hz to 500Hz frequency interval are allowed to pass through.

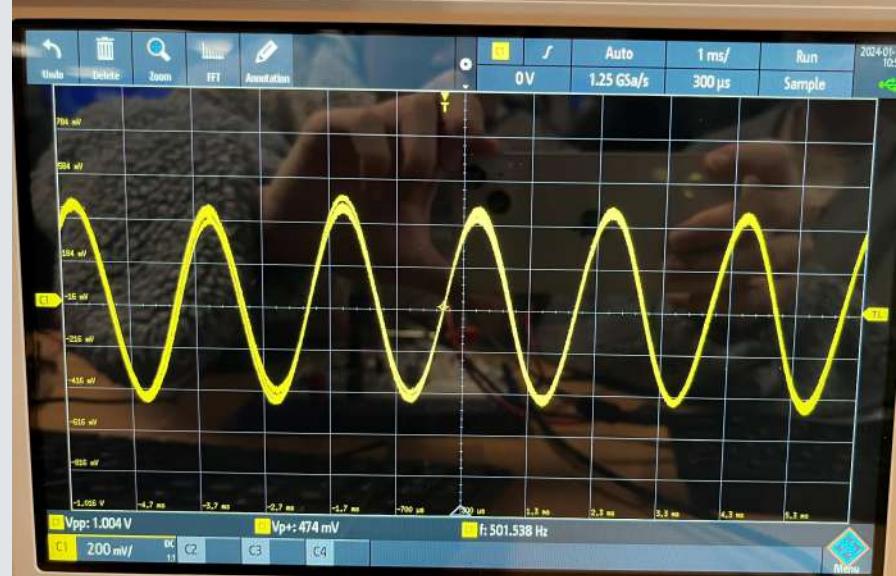
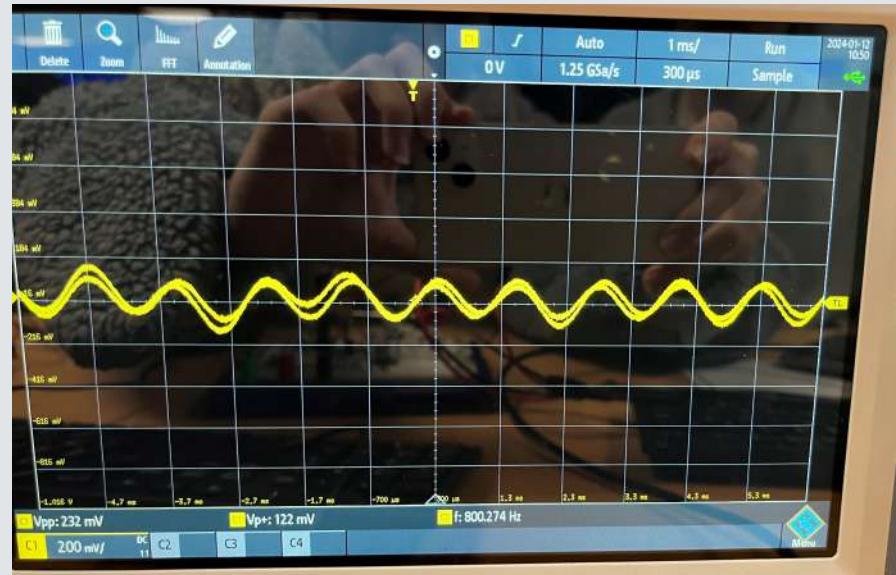
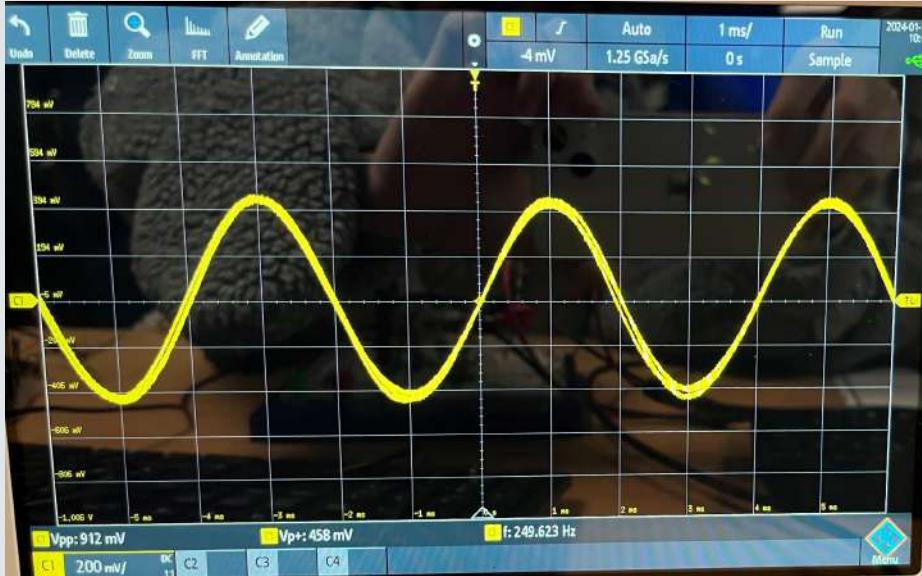
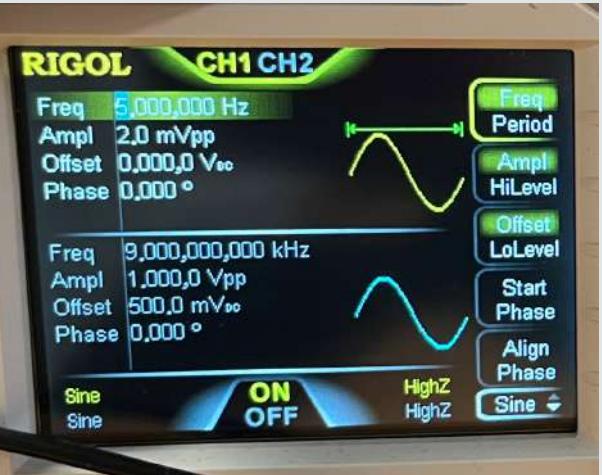
Filter



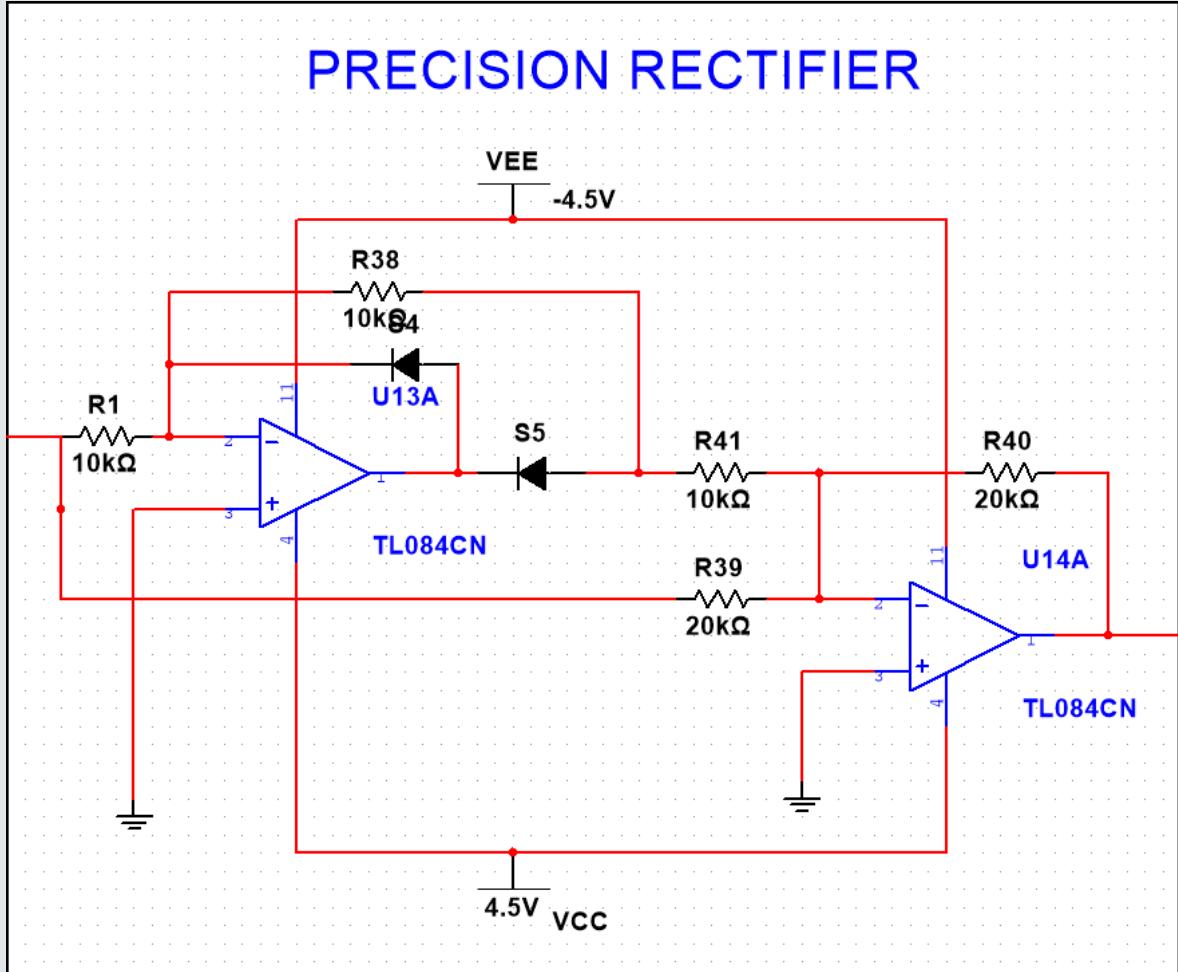
Simulation Result
Yellow line is the input
Blue line is the output



Filter



Rectifier

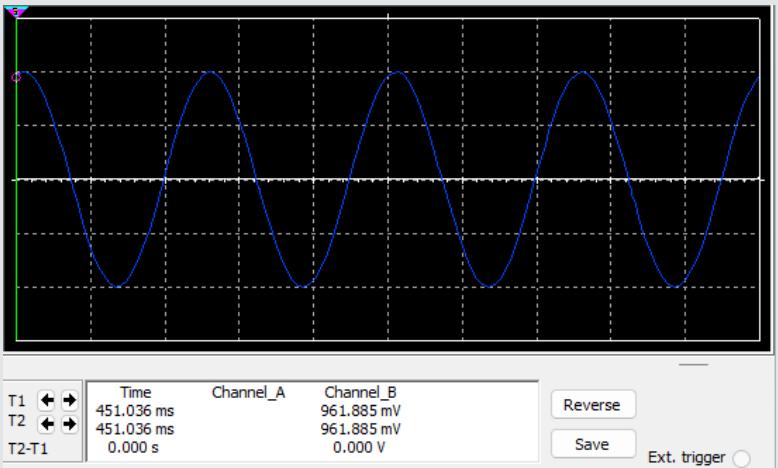


- Super diode, suitable for small signal processing
- Full wave used
- Using TL084 for low frequency signal processing
- Rectifying the signal.

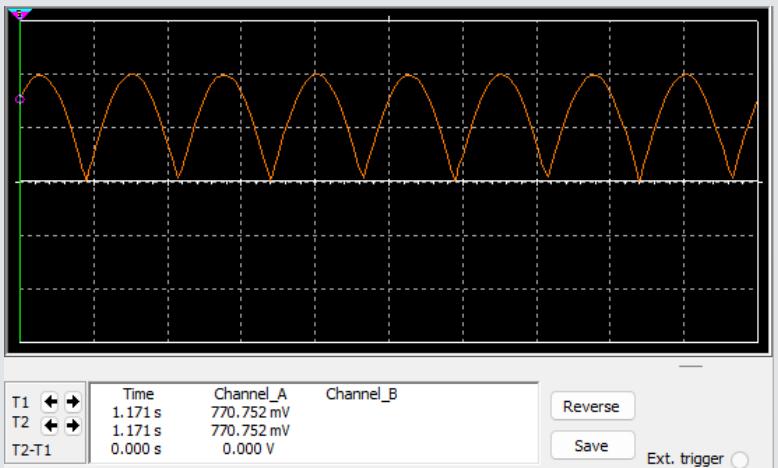
Rectifier

Simulation Result

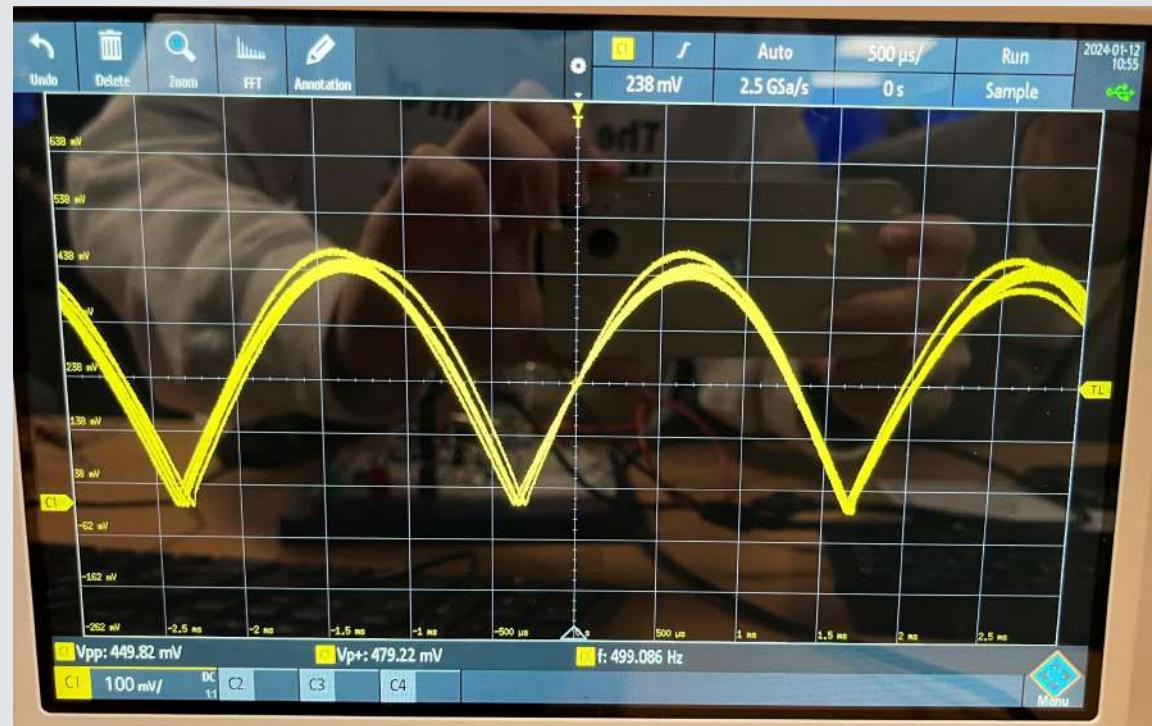
Input



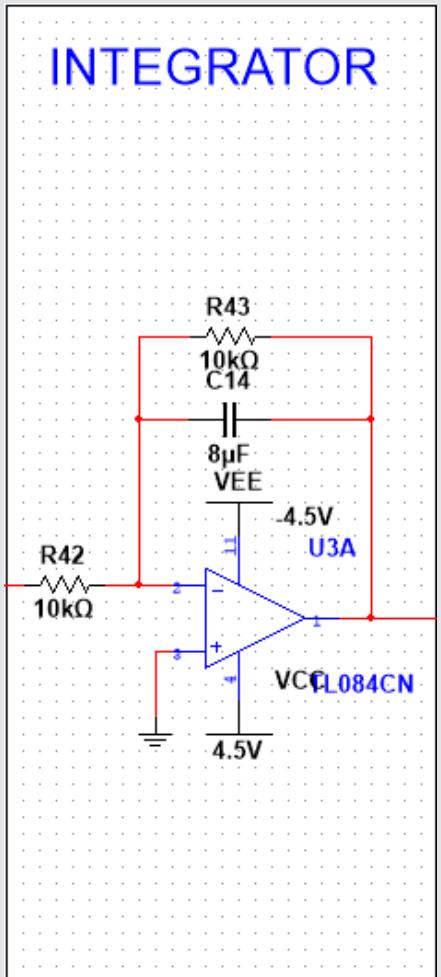
Output



Real Circuit Result



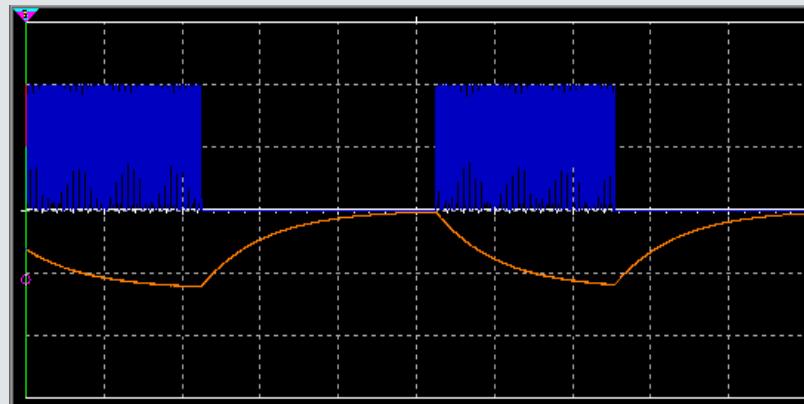
Integrator



Input

Simulation Result

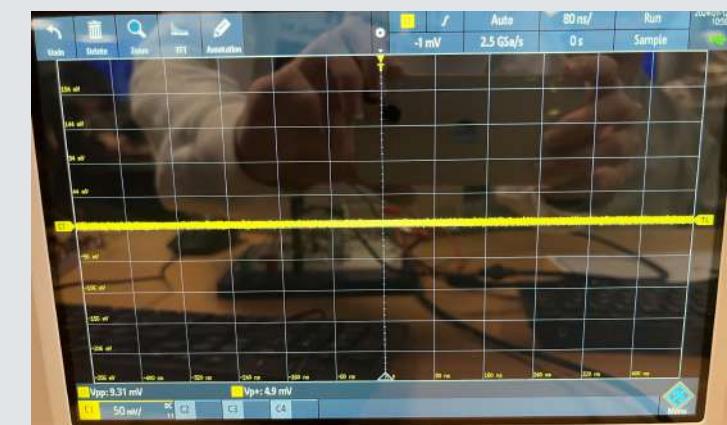
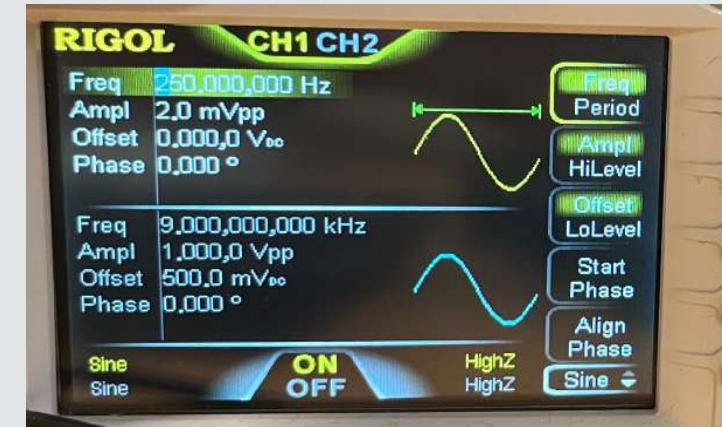
(Blue input and orange output)



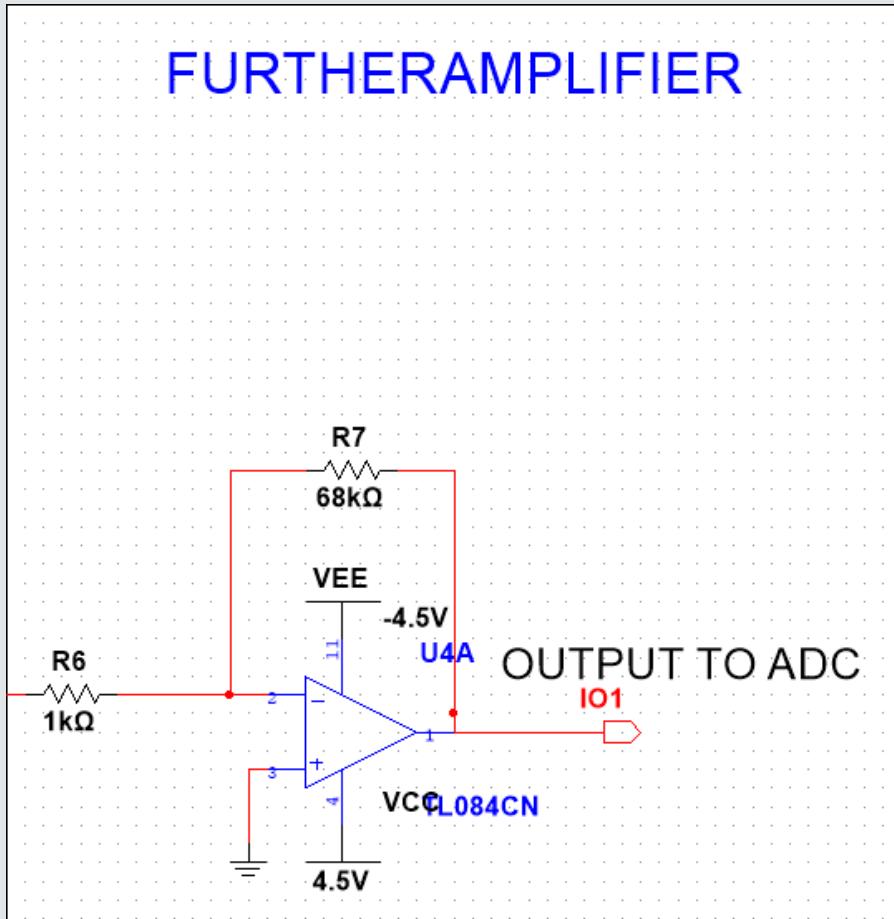
Output

- 1.7Hz corner frequency
- Mean estimation

Real Circuit Result



Further-amplifier

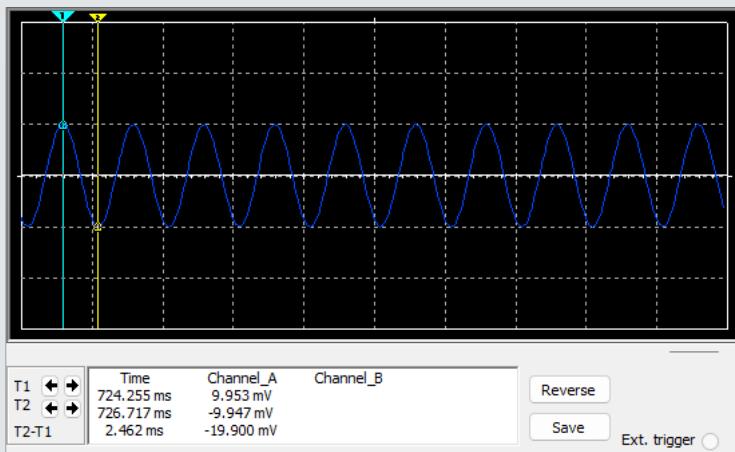


- Invert the result of output of integrator
- Gain = 68
- The output signal voltage in range 500mV to 2.9V

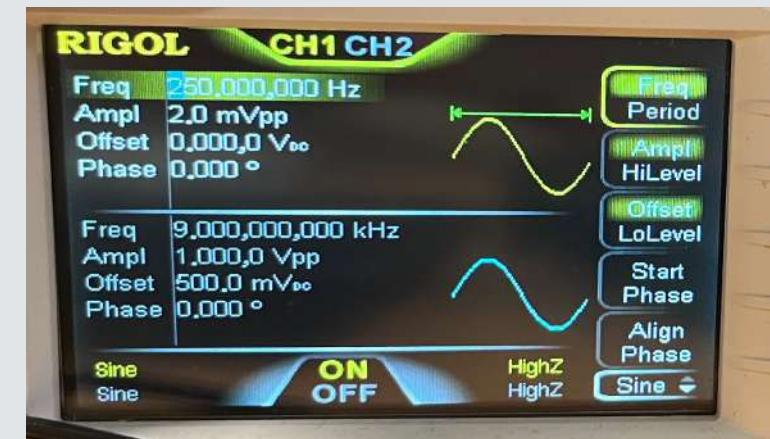
Further-amplifier

Simulation Result

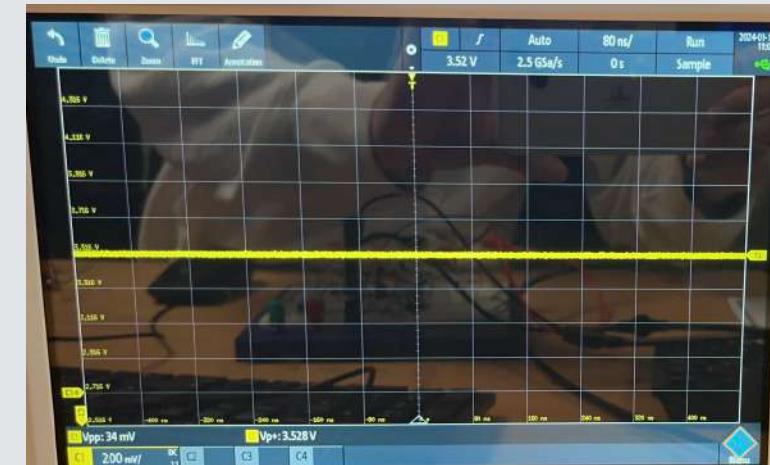
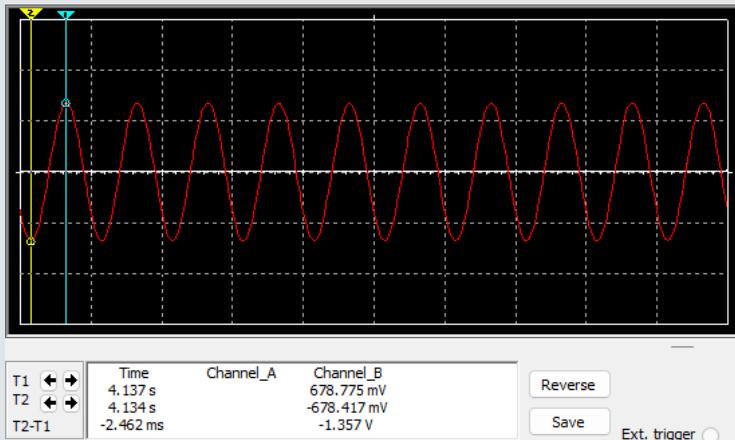
Input



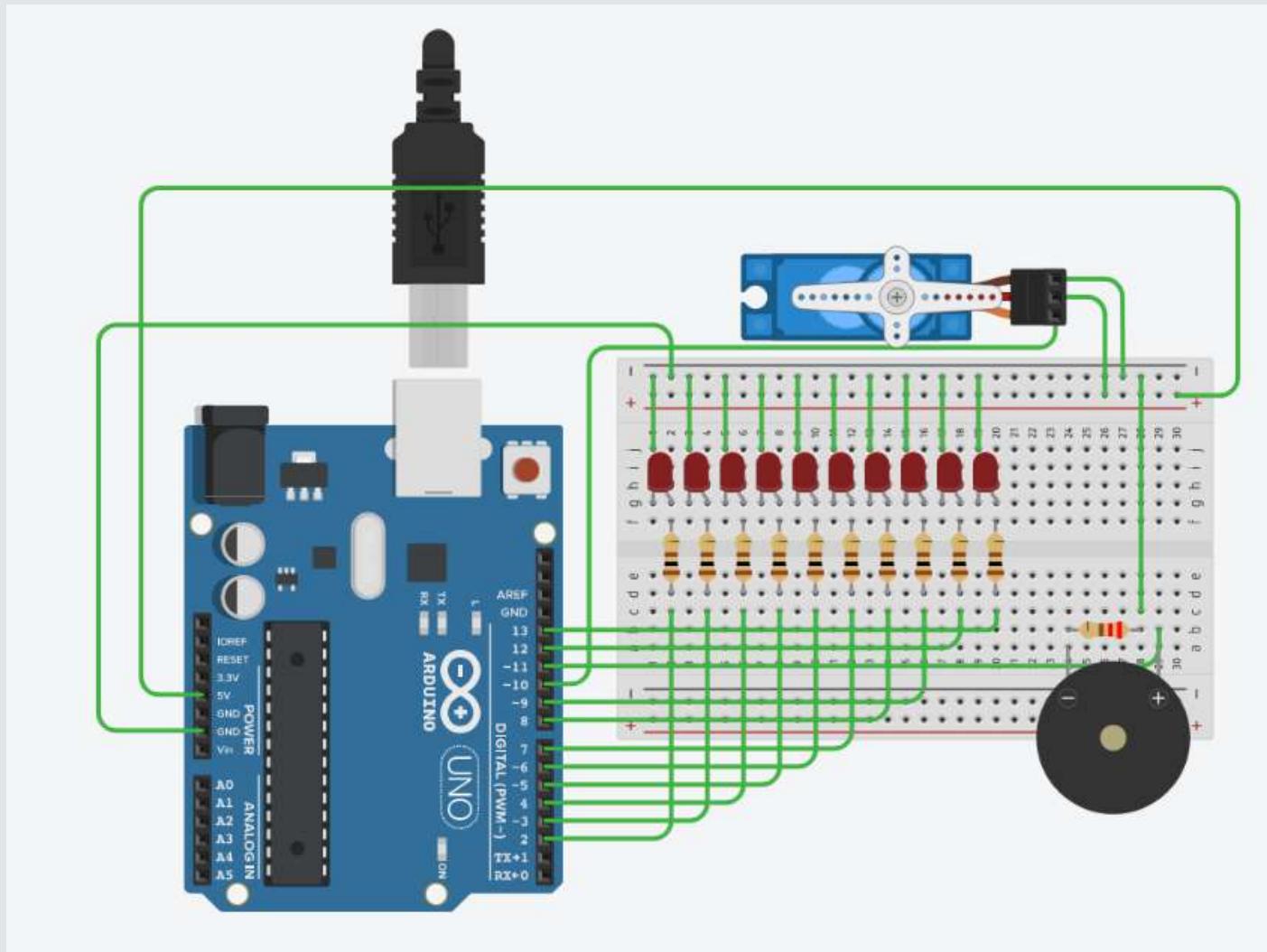
Real Circuit Result



Output



Output



LED bar:

As the value increases, the number of lights on increases

Buzzer:

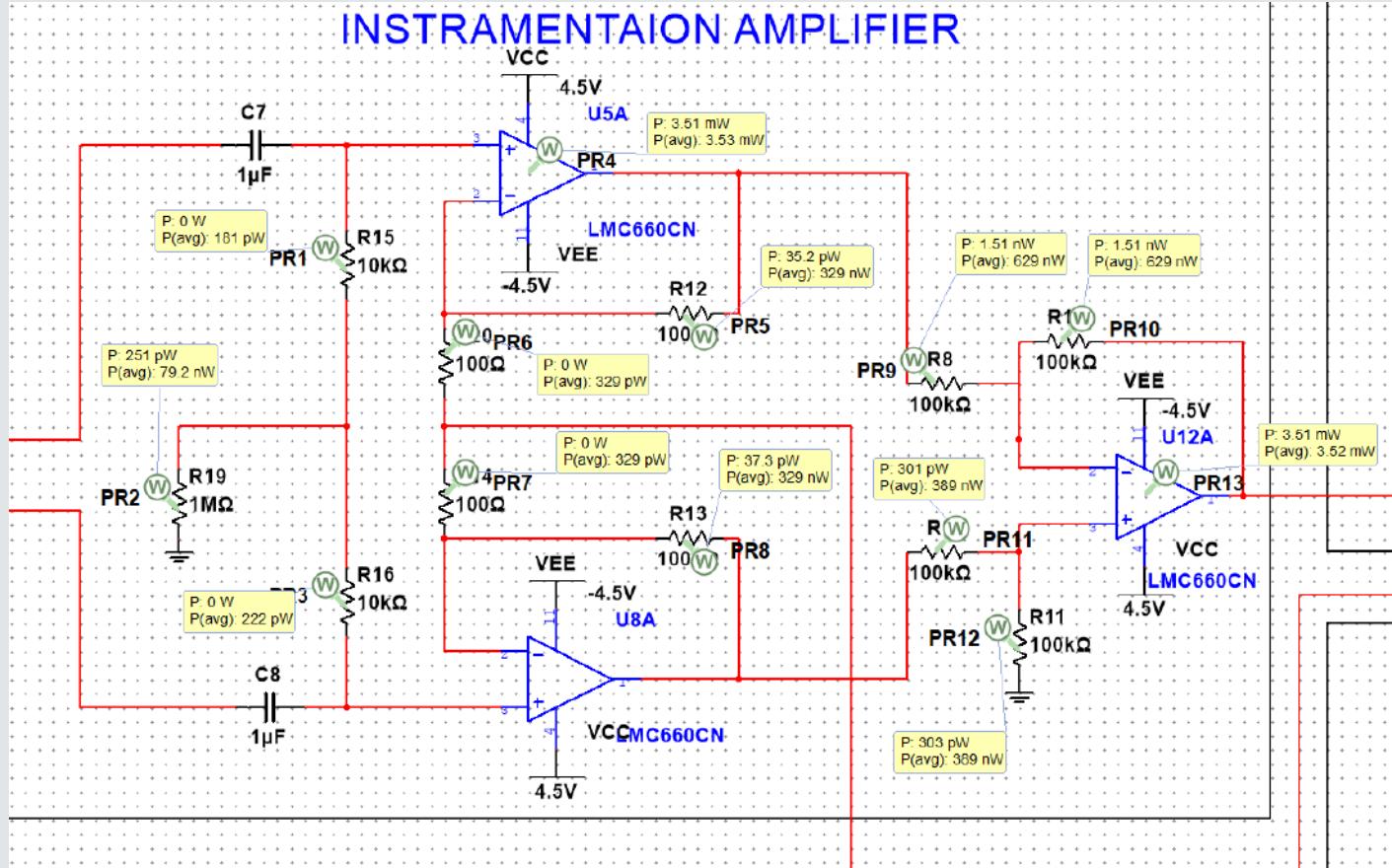
As the value increases, the tone of the sound produced increases

Servo motor (extra output):

Displaying muscle values from different angles

Power calculation

Calculation: using multisim power probe to calculate the power of individual component and add all together



Power calculation

12:15 1月12日周五

练习本

$P_{\text{InA}} = 3184 \text{ nW} + 10.1 \text{ mW} + 74.4 \mu\text{W}$

$P_{\text{drc}} = 920.5 \text{ nW} + 78.2 \text{ mW} + 27.3 \mu\text{W}$

$P_{\text{filter}} = 6.18 \text{ nW} + 1727.2 \text{ pW} + 10.54 \text{ mW}$

$P_{\text{rectifier}} = 1133.1 \text{ nW} + 79.2 \text{ mW} + 1.26 \mu\text{W}$

$P_{\text{integrator}} = 471.9 \text{ nW} + 39.6 \text{ mW}$

$P_{\text{further}} = 70.2 \text{ mW} + 39.5 \text{ mW}$

$P_{\text{total}} = 4695.68 \text{ nW} + 25714 \text{ mW} + 173.16 \mu\text{W} + 1727.2 \text{ pW}$
 $\approx 0.262 \text{ W}$



Components

Components	Model	Amount	Individual Price (£)	Total Price(£)	Reference from
Orangepip	kona 328	1	14.95	14.95	Orangepip
EMG electrode	None	3	1	3	RS UK
LED bar	10 elements multi-color (red, yellow, green)	1	5.3	5.3	Farnell
Servo	SG90	1	3.9	3.9	Farnell
Buzzer	0905	1	3.9	3.9	Farnell
Breadboard	(Big)	1	22.5	22.5	Farnell
Breadboard	(Small)	1	3.6	3.6	RS UK
cable	0.6 single core cable	~2m	13.46m/150	0.179	Farnell
jumpwire	None	8	0.149	1.19	Amazon

Components

Components	Model	Amount	Individual Price (£)	Total Price(£)	Reference from
Amplifiers	LMC660CN/NOPB (4 amplifier, CMOS input)	1	0.62	0.62	Farnell
Amplifiers	TL084 (4 amplifiers, JFET input)	2	0.93	1.86	Farnell
PP3 battery	9V	1	2.26	2.26	Amazon
PP3 battery clip	HH-3449	1	1.32	1.32	Amazon
Resistors	Serveral values	45	0.131	5.895	Farnell
Capacitors	Ceramic capacitor	14	0.107	1.498	Farnell
Diode	1n4001	2	0.192	0.384	Farnell
Insulation Tape	20 Metres, blue	1	1.99	1.99	Amazon
Crocodile clip	Alligator Clips	3	0.113	0.339	Amazon

Cost evaluation

- Total Price is 75.205£