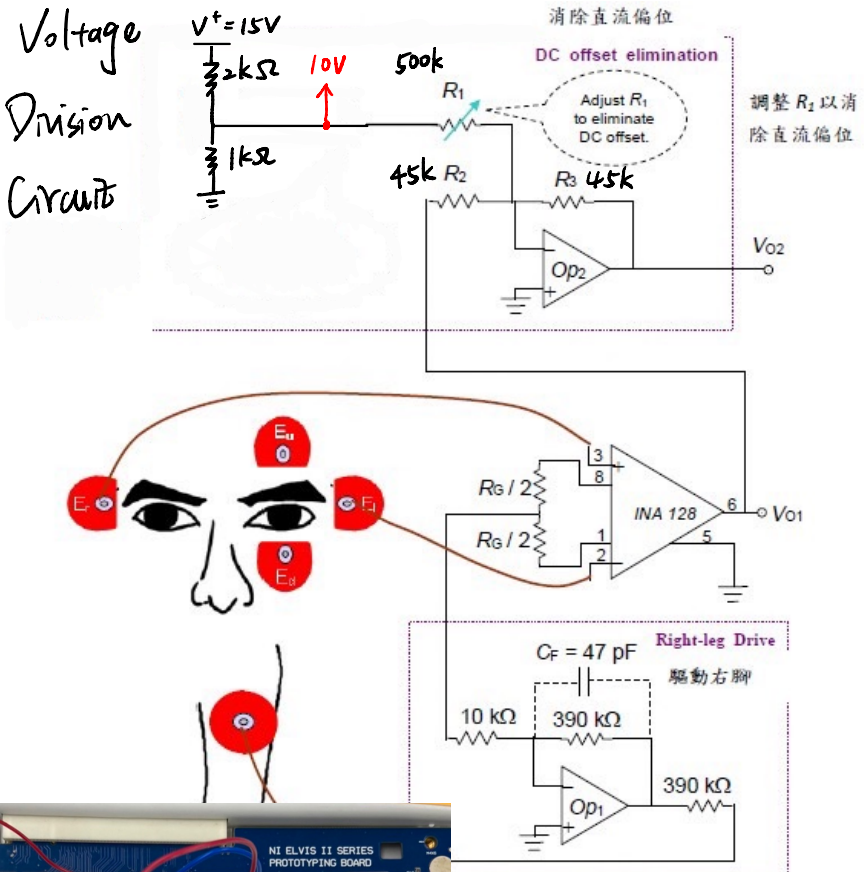
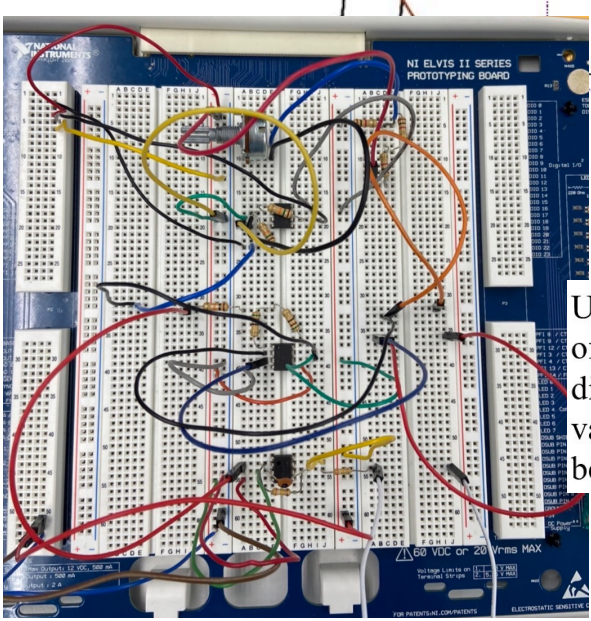
Lab 8 Electro - Oculogram 0811562 何祁恩

Voltage Division Circuit

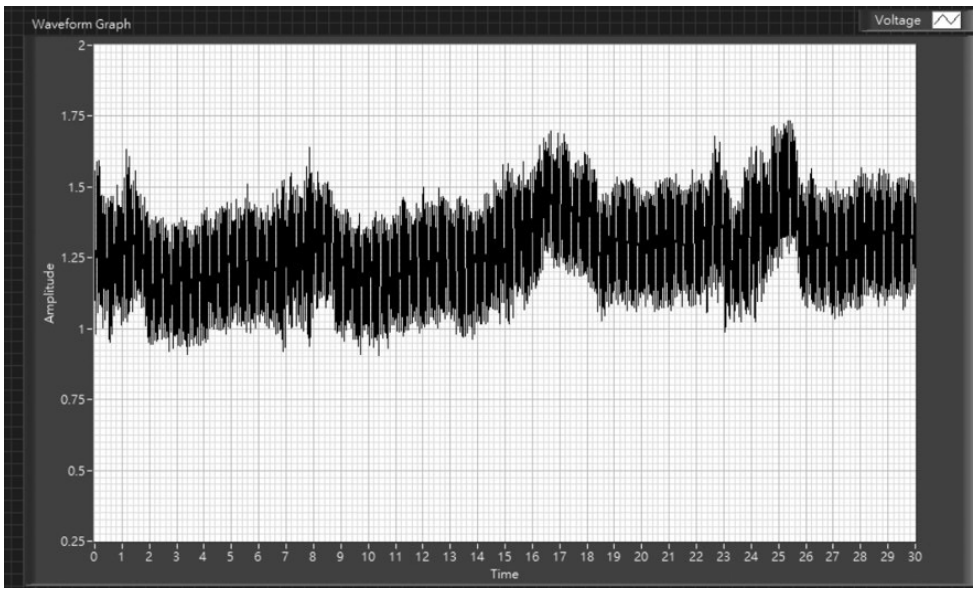




Using the original circuit to eliminate DC offset is so hard, therefore, adding a voltage divider circuit on the voltage source of the variable source. The DC offset voltage can be decreased to about 0.1V.

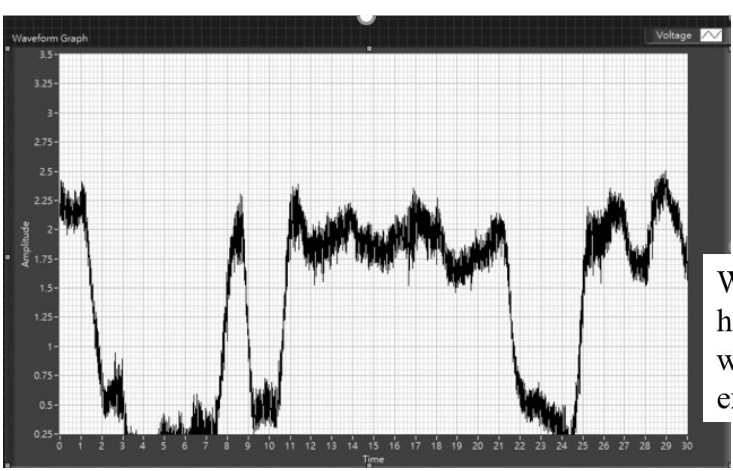
< Phase 1 >

1. Blink eyes.



When the subject blinks their eyes, the EOG signal will go up and down. In the figure above, one can observe the four times blinking by the subject.

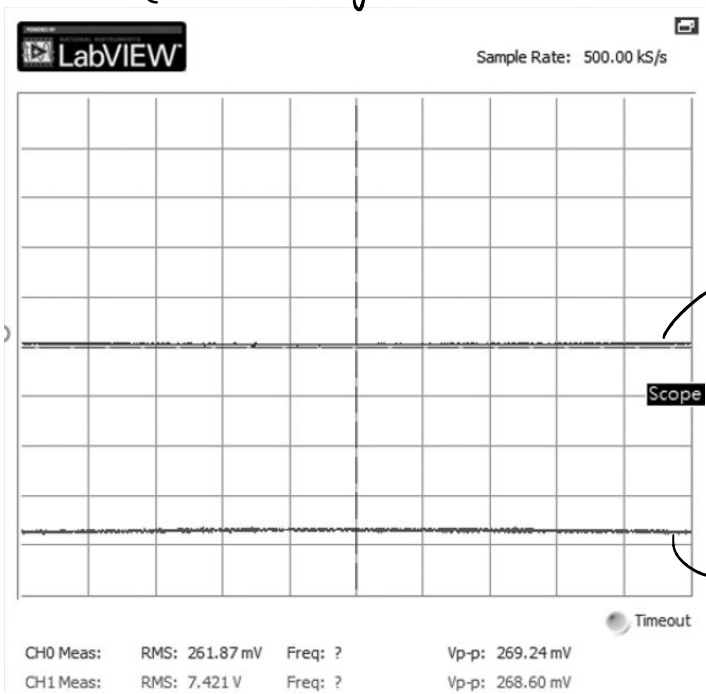
2. Grind tongue



When the subject is grinding his/her tongue, the EOG signal will become not predictable and exists a lot of noise.

<Phase 2>

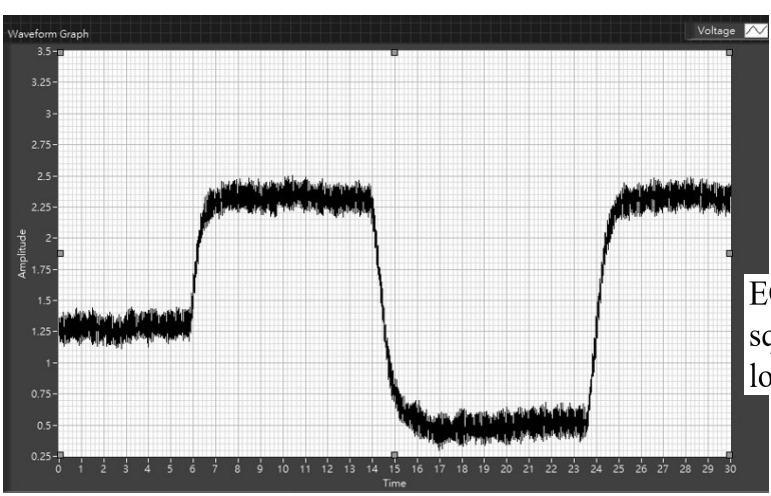
V_{o1} & V_{o2} eliminate DC offset (ELVIS)
(without voltage divider circuit on variable resistance)



V_{o2} (CH0)
5V/Div

V_{o1} (CH1)
2V/Div

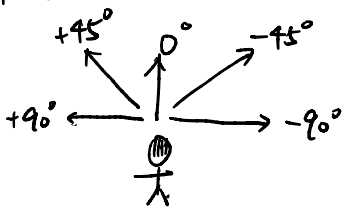
Look left and right:



EOG signal becomes almost a square wave when the subject look from left and right.

Horizontal EOG Detection ($R_1 = 25\,k\Omega$)

Angle definition



R_G	R_2	R_3	Gain in Diff Amp Stage	Gain in DC Offset Elimination Stage	Max – min of V_{O2} average	Max – min of real EOG signal
51Ω	45kΩ	45kΩ	≈ 100(V/V)	1V/V	1.6V	0.016V

Degree	V_{O1} Average
+90°	1.1V
+45°	1V
0°	0.01V
-45°	-0.5V
-90°	-0.5V

When the subject looks to the left, the average EOG signal will rise. When the subject looks to the right, the average EOG signal will decrease.

<Phase 3>

Vertical EOG Detection (R_1 = 266 kΩ)

R_G	R_2	R_3	Gain in Diff Amp Stage	Gain in DC Offset Elimination Stage	Max – min of V_{O2} average	Max – min of real EOG signal
51Ω	45kΩ	45kΩ	≈100V/V	1 V/V	1.15V	0.115V

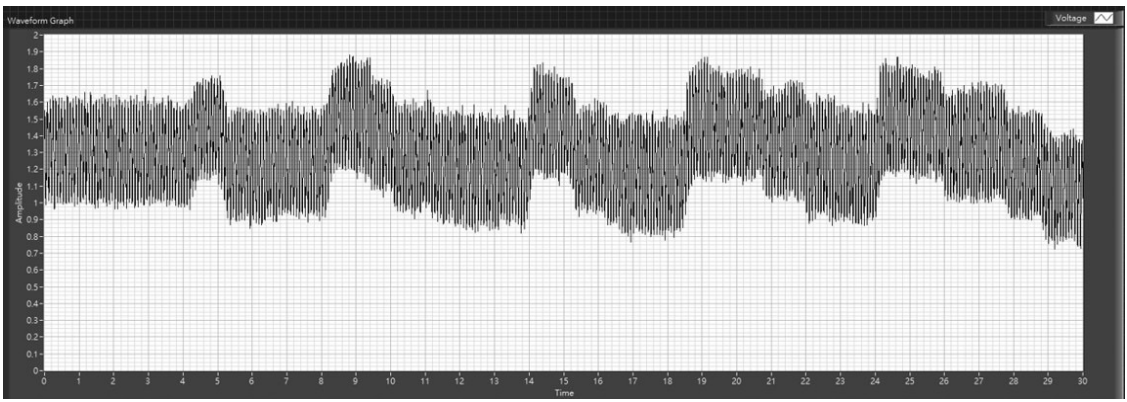
Degree	V_{O_2} Average
+90°	0.9V
+45°	0.7V
0°	0.45V
−45°	1.3V
−90°	1.6V

Repeating measuring the vertical EOG signal, it seems that there exists no pattern in this experiment. We can't conclude any rule in this vertical EOG detection.

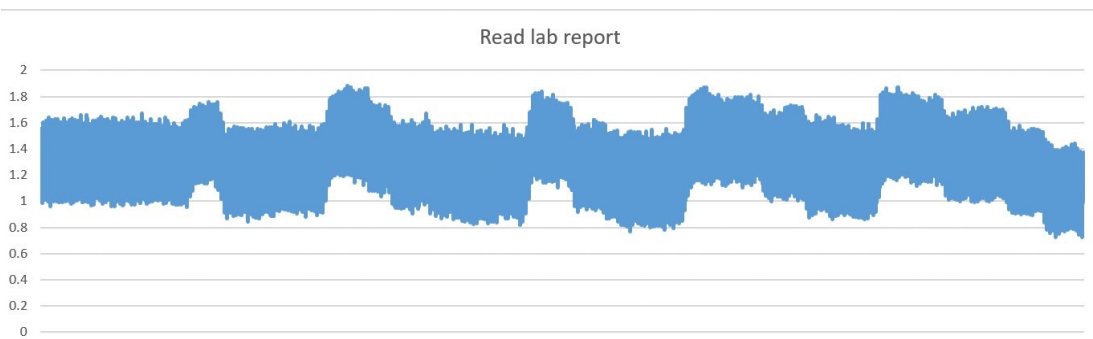
<Phase 4>

1. Read lab material

(a) Labview waveform



(b) Export Excel

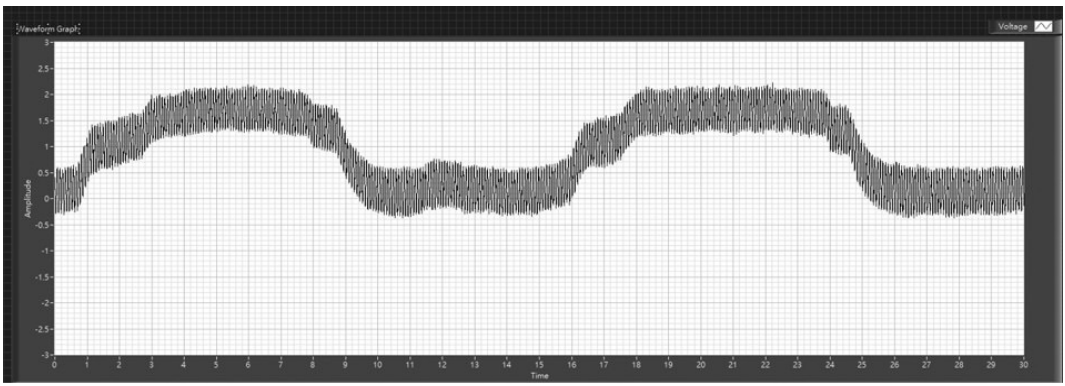


From the waveform above, we can clearly see that subject read five lines in 30 seconds, there exist 5 similar patterns in this waveform. The shape of the repeated waveform is the same as the ramp.

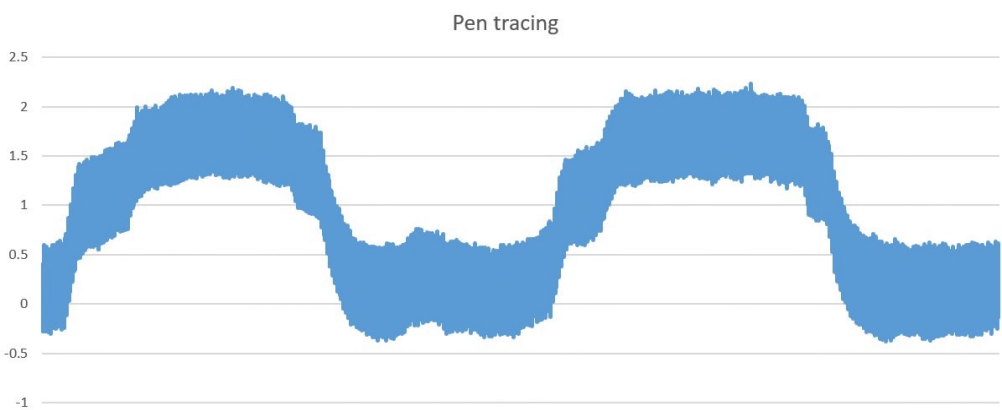
2,

Eyes follow pen.

(a) Labview waveform



(b) Export Excel



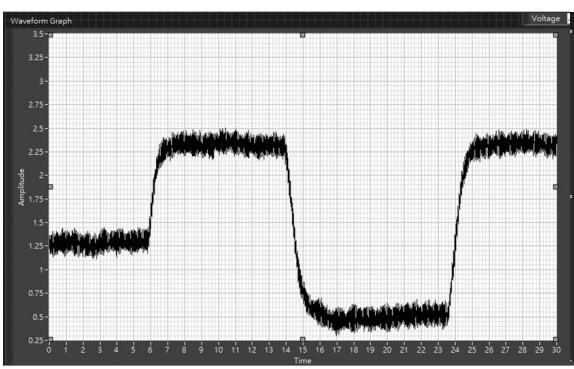
The subject's eyes follow the pen moving left and right, therefore, the EOG waveform goes up and down.

Question and Discussion

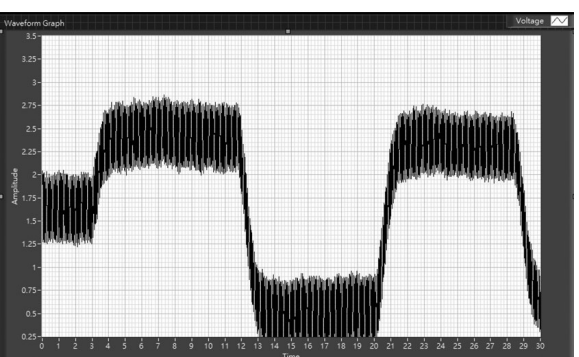
1. Develop an EOG application that is not in place, not restricted in any field.

For those disabled people, we can project the control panel on the special fully designed glasses and use the EOG signal to detect where does the subject looking at. When he/she wants to control the wheelchair to go forward or backward, one can simply blink his/her eyes on the control panel on the glasses. Therefore, for those disabled people, they can move all on their own without others' help.

2. If we move the reference electrode to chin or forehead from right leg, would the result differ?



↑reference from right leg



↑reference from forehead.

From the left graph, the reference electrode is connected to the right leg. The noise on both the high peak and the low peak has a little noise. From the right graph, the reference electrode is connected to the forehead. The noise and DC offset on the EOG signal both increase.

3. Are there any differences in testing signals for phase IV?

The subject's eyes trace the pen moving left and right slowly, therefore the waveform is relatively smooth. However, when the subject reads the lab report, there exists a big change at the end of the line, therefore, the pulse on the waveform can be observed.

* Feedback:

I have never heard the EOG signal before. It is quite interesting to know when eyes blink and move, we can receive the electrical signal, and get further information on the electrical signal. Looking forward to the application of the EOG signal in the future!