

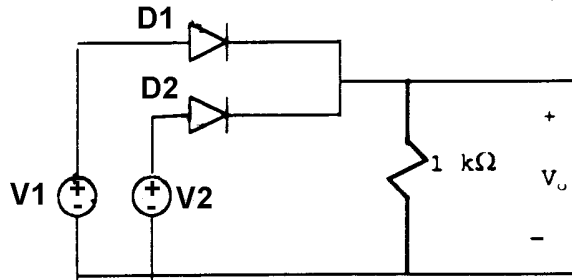
ELECTRONICS I
LAB 2 Diode II

TRADITIONAL LAB

Diode Applications

A.

1. Set up the silicon diode circuit shown. Change v_1 and v_2 . Record the output voltage v_o for every step.

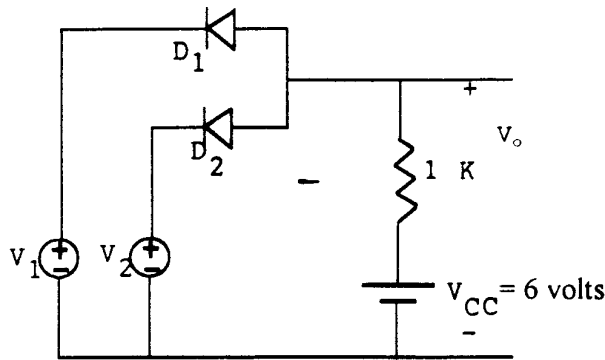


V_1	V_2	V_o
0	0	
0	5	
5	0	
5	5	

Units: Volts
Note $v = 0$ means short circuit.

Fig.2.2

2. Repeat A 1 for Fig. 2.3



V_1	V_2	V_3
0	0	
0	5	
5	0	
5	5	

Units: Volts

Fig. 2.3

3. Construct the circuit shown in Fig.24. Vary the input voltage v_i . Measure the output voltage v_o and the current I_2 .

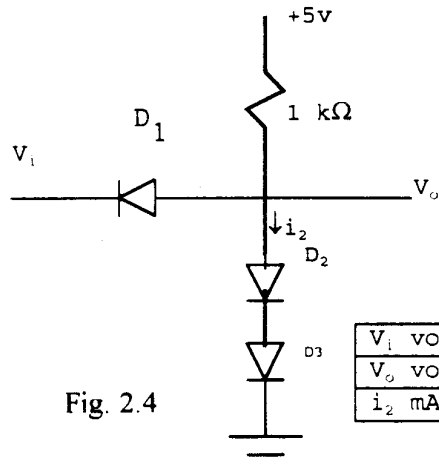


Fig. 2.4

V_i volts	2	1	0.7	0	-1
V_o volts					
i_2 mA					

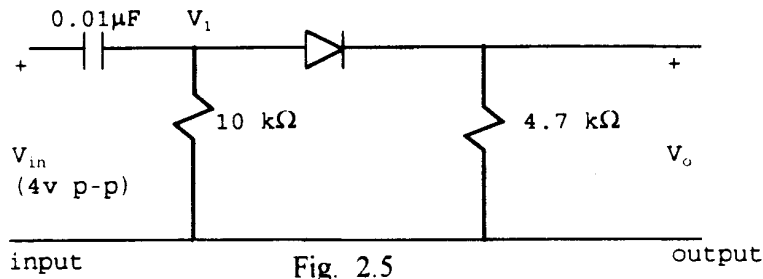
Explain the results obtained and the application for each circuit. Assume the constant voltage source or linear approximation model for the diodes.

Also compare your experimental results with Electronics Workbench/PSPICE program results for the above circuits in part A.

B.

1. Rectified Differentiator

Construct the circuit shown.



Drive the circuit with 500 Hz square wave 4v p-p. Use a scope to record (sketch) v_{in} , v_1 and output v_o . Record all scope scales. justify the waveforms obtained. Find expressions for the transfer functions $V_1(s)/V_i(s)$, and $V_o(s)/V_i(s)$ and explain range of frequencies for the circuit to function as a differentiator. (You may assume ideal diode model). Discuss the applications) of this circuit.

C. Square Wave Generator Design

Design, build and test a circuit which will generate a square waves 2v p-p at 1 Kz from a 1 Kz sine wave function generator. Compare the results of your design with a regular square wave of the same frequency. Indicate rise time and fall time of each wave. State alternate designs to improve on your "crude" square wave generator.

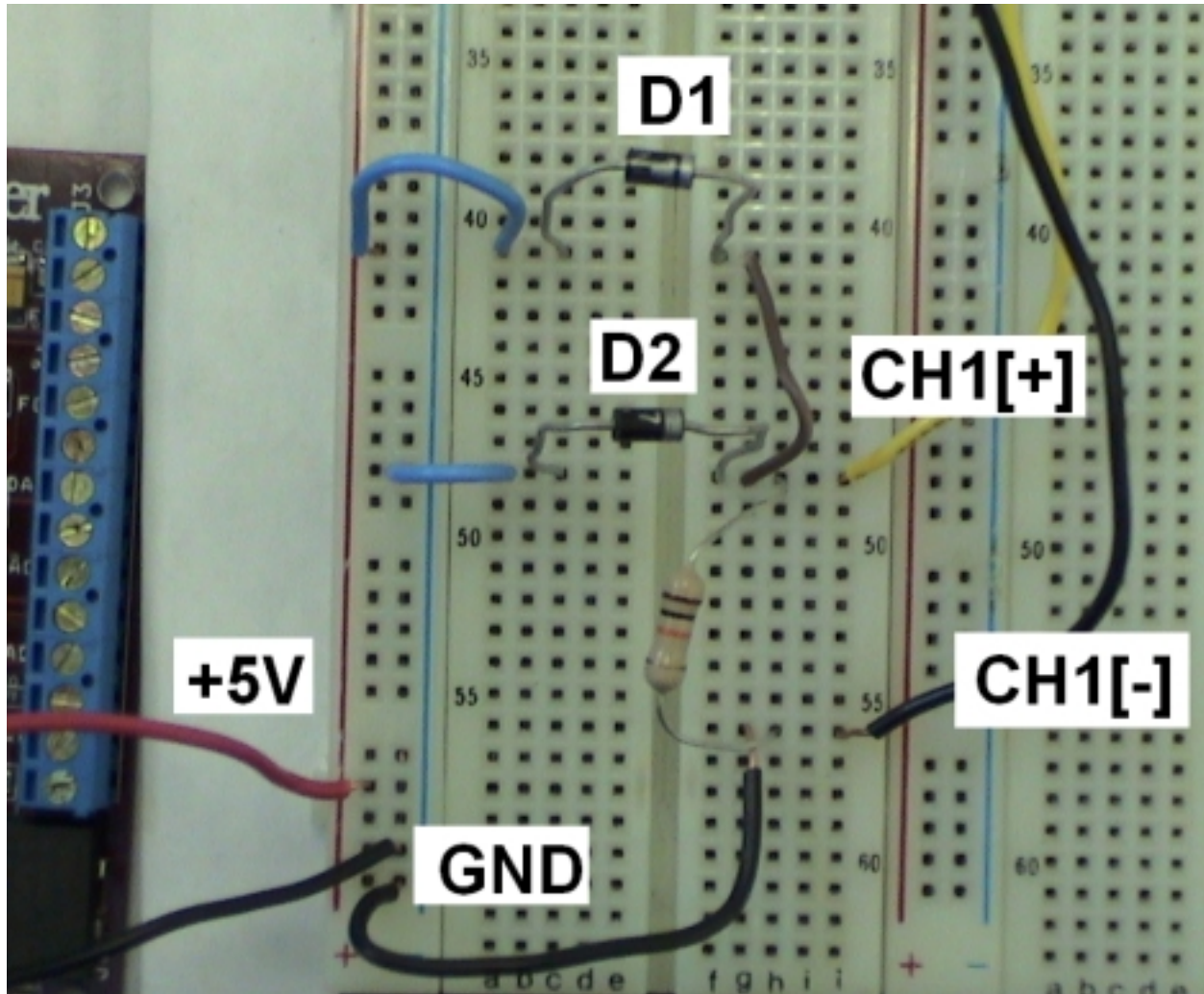
MOBILE STUDIO IMPLEMENTATION

Part A

1. Experiment for Fig2.2.

Since *IOBoard* has +5V source, there should not be any problem in this lab setup. We will measure the output voltage V_o using channel 1 probes of the *IOBoard*.

The picture below shows when D1 is supplied by +5V, and D2 by 0V.

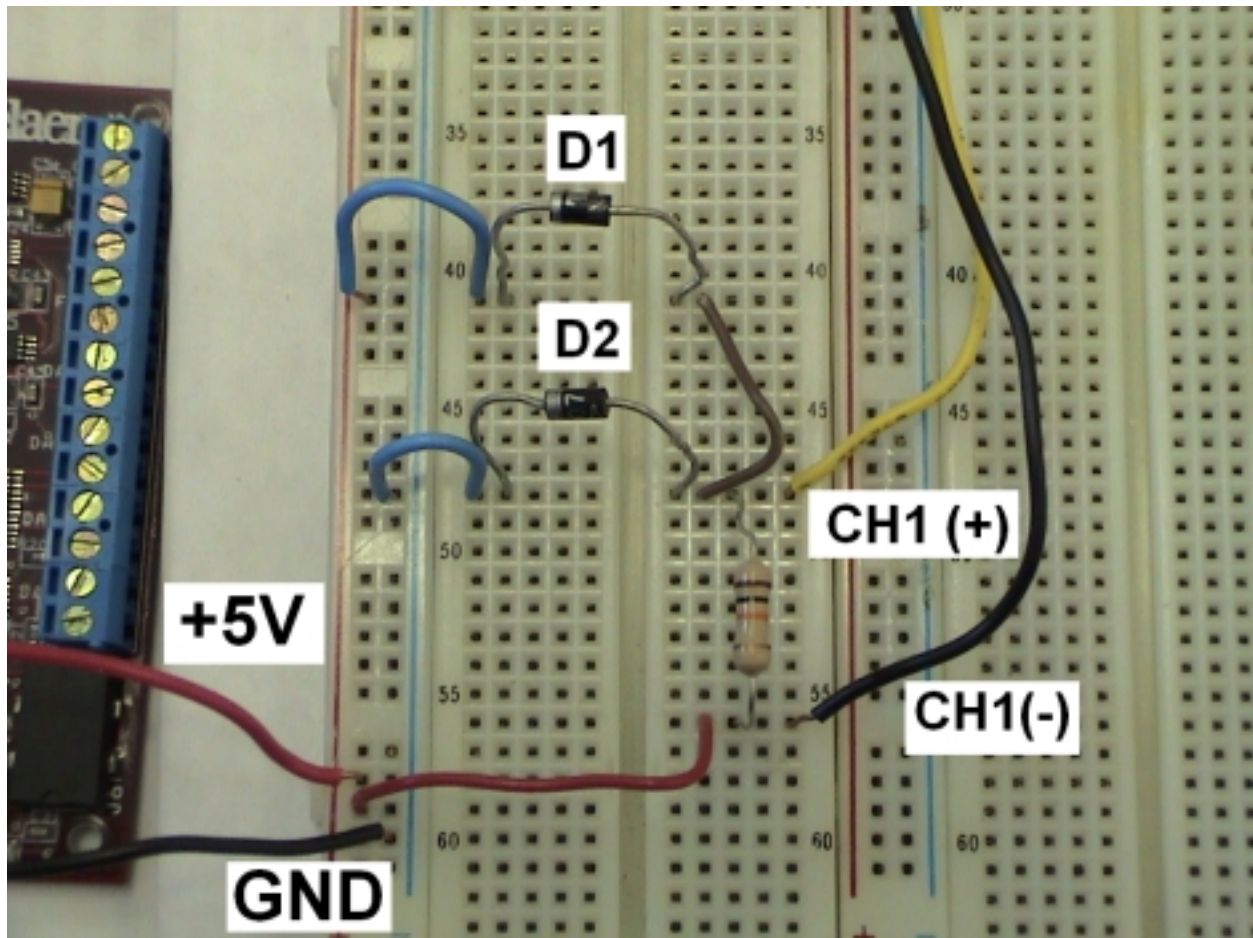


After you make the USB connection, you run the oscilloscope function of the *Mobile Studio Desktop*. And Click *Start* to get the output.

2. Experiment for Fig 2.3.

Everything is exactly same as far as IOBoard connection is concerned except that we can use the same +5V in place of the V_{cc} ($=6\text{ V}$) in the figure. V_3 in the table is the output voltage V_o .

The picture below shows when D1 is supplied by +5V, and D2 by 0V.



After you make the USB connection, you run the oscilloscope function of the *Mobile Studio Desktop*. And Start.

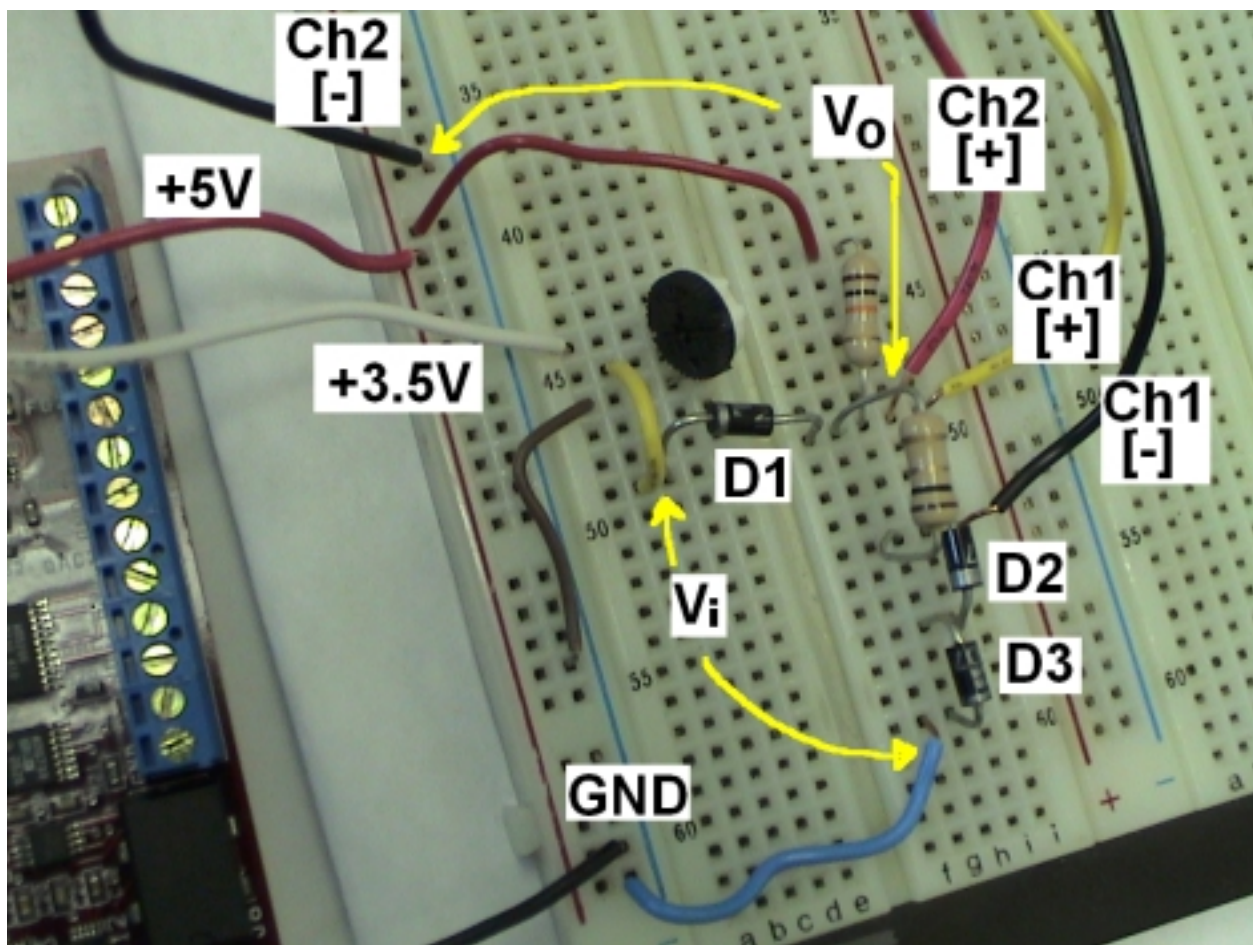
3. Experiment for Fig. 2.4. There are two concerns in this experiment. (1) The input voltage must be variable with positive and negative voltages, and (2) measurement of current through the diodes D2 and D3 must be accommodated.

Variable Voltage Supply at the Input Side: As we discussed in LAB 1 we can get the variable voltages easily: (a) we provide positive voltages using **+3.5V source** of *IOBoard* and a variable resistor, and (b) we provide negative 1V from **-2.5V source** of *IOBoard* and a variable resistor.

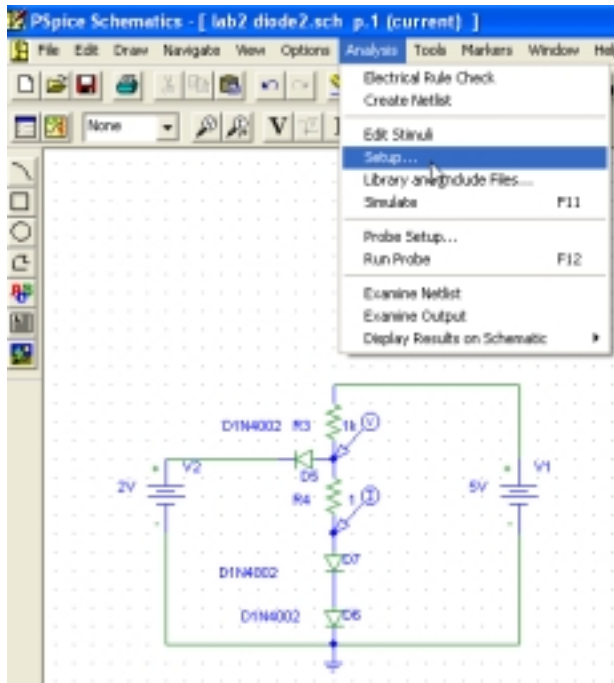
Current Measurement through the Diodes: As you remember in PSpice, we can connect very small resistor to have an effect of short circuit. So we will connect 1Ω resistor in series with the diodes D2 and D3. To get the current through the diodes, we read the voltage across the 1Ω and that's the current (by $V/R=I$).

For Fig 2.4 experiment, we dedicate channel 2 probes for current (actually voltage across the 1Ω resistor) measurement. Channel 2 probes are first used to set the input voltage from the variable resistor, then moved to measure the voltage at the output.

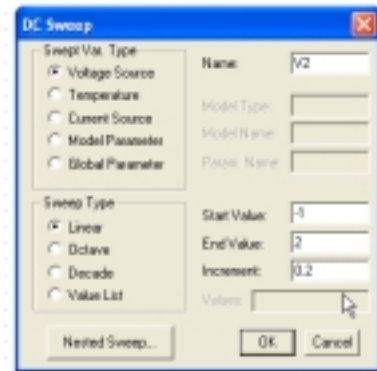
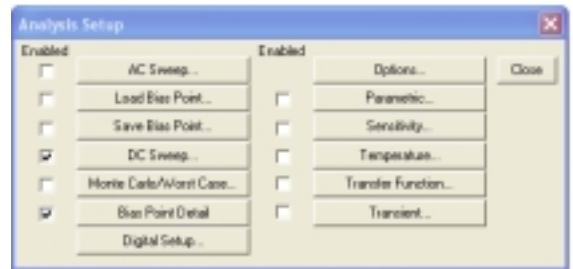
The picture below shows the connection with 1Ω resistor, +5V and +3.5V sources from *IOBoard*, variable voltage output via a variable resistor, and the experiment circuit itself. Here, Channel 1 measures the voltage across the 1Ω resistor (and thus the current), and Channel 2 the output voltage V_o . Note that V_o is the node voltage which is the voltage between the node and the ground.



The Pspice simulation of the above circuit is illustrated with the following screen shots.

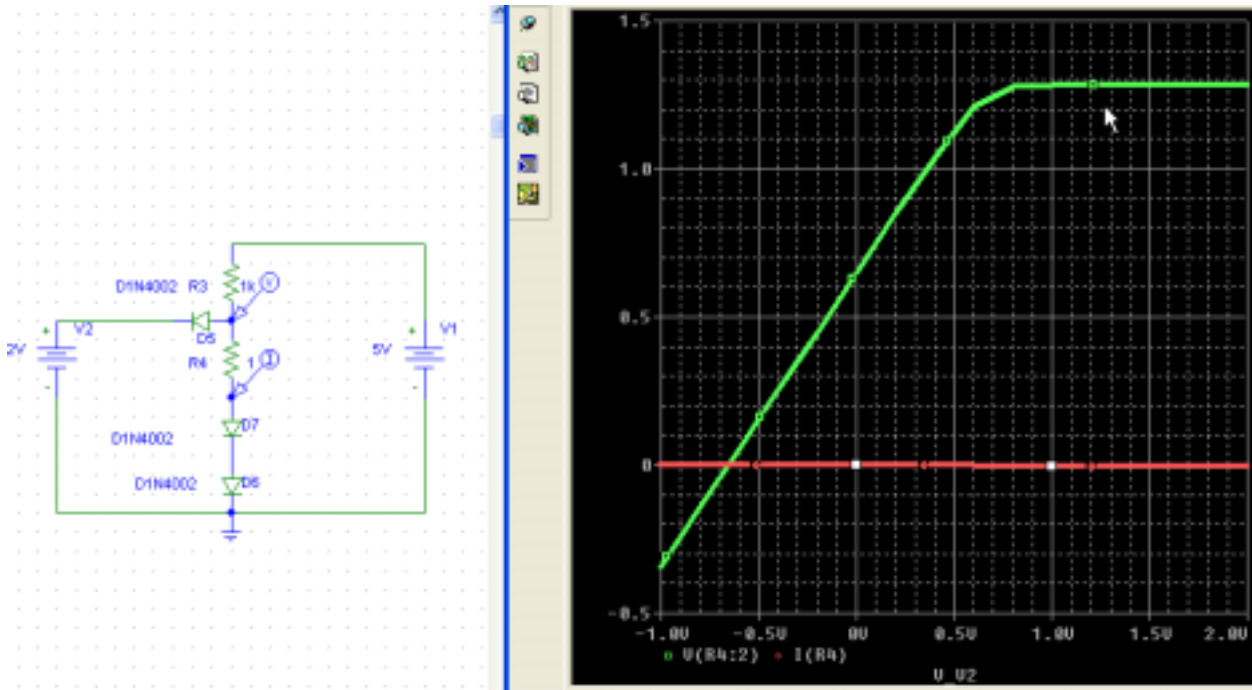


Analysis Setup for DC sweep



DC Sweep Setting for V2

In the DC sweep, the voltage V2 will be changed from -1V to 2V with the step of 0.2V. The plot of V2 vs. {Output voltage and current} is shown below.

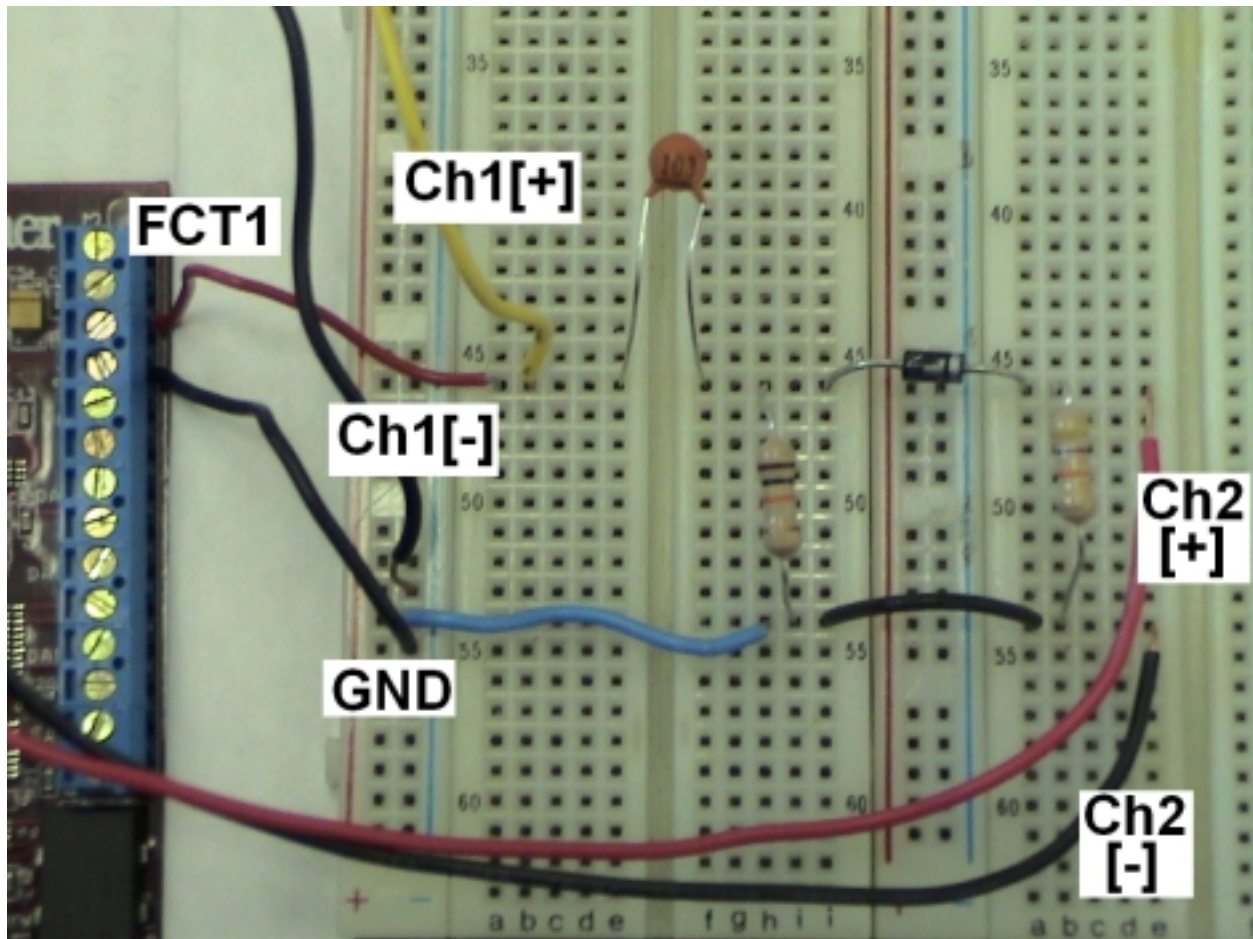


Part B

1. Experiment for Fig 2.5

The biggest problem with IOBoard function generator is that the peak-to-peak output is only about 1V. Above that would distort the output waveform or be not responsive. However, whether you supply $4V_{pp}$ or $1V_{pp}$, you have the same result in this experiment.

The picture below shows the circuit connection with function generator 1 output as input signal to the main circuit. The channel 1 measures this input waveform, and the channel 2 measures the output voltage.

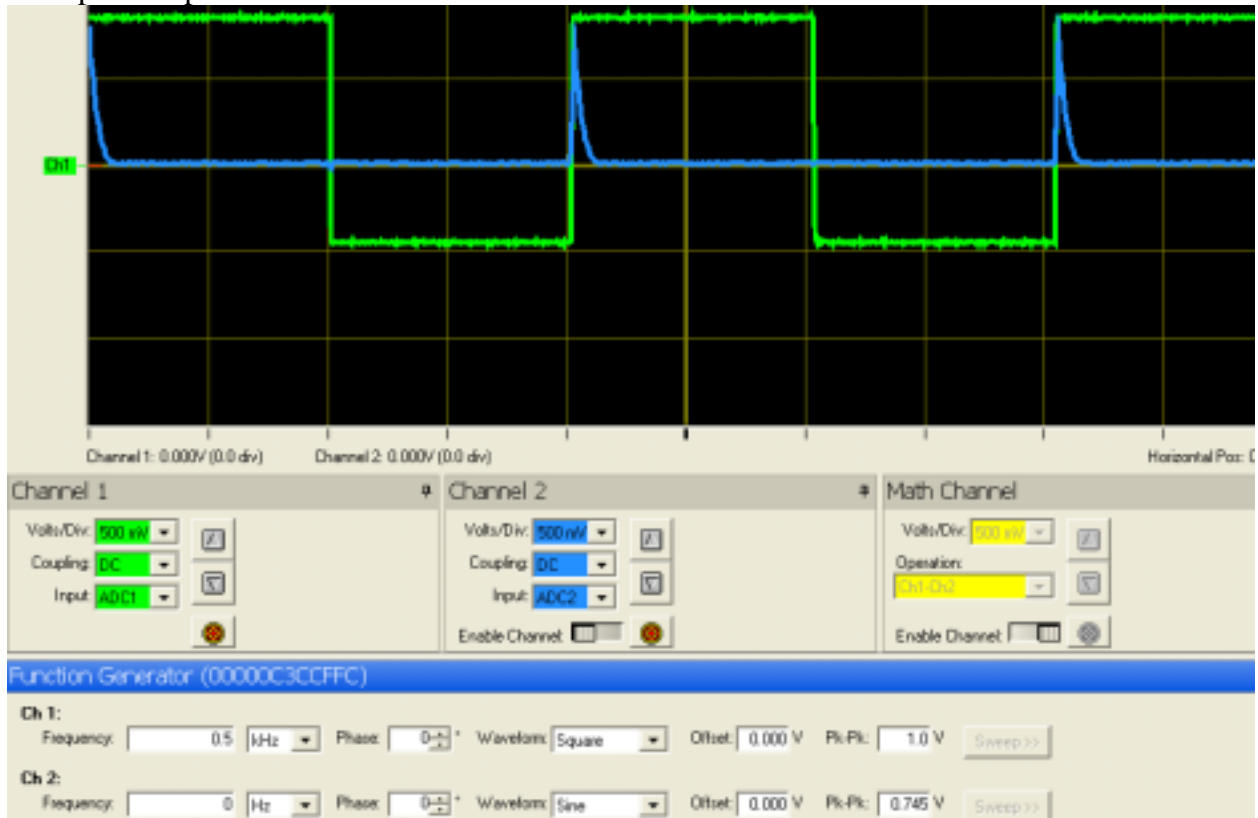


Once this circuit connection is finished, connect this *IOBoard* to your computer via USB cable. Then click open the *Mobile Studio Desktop*.

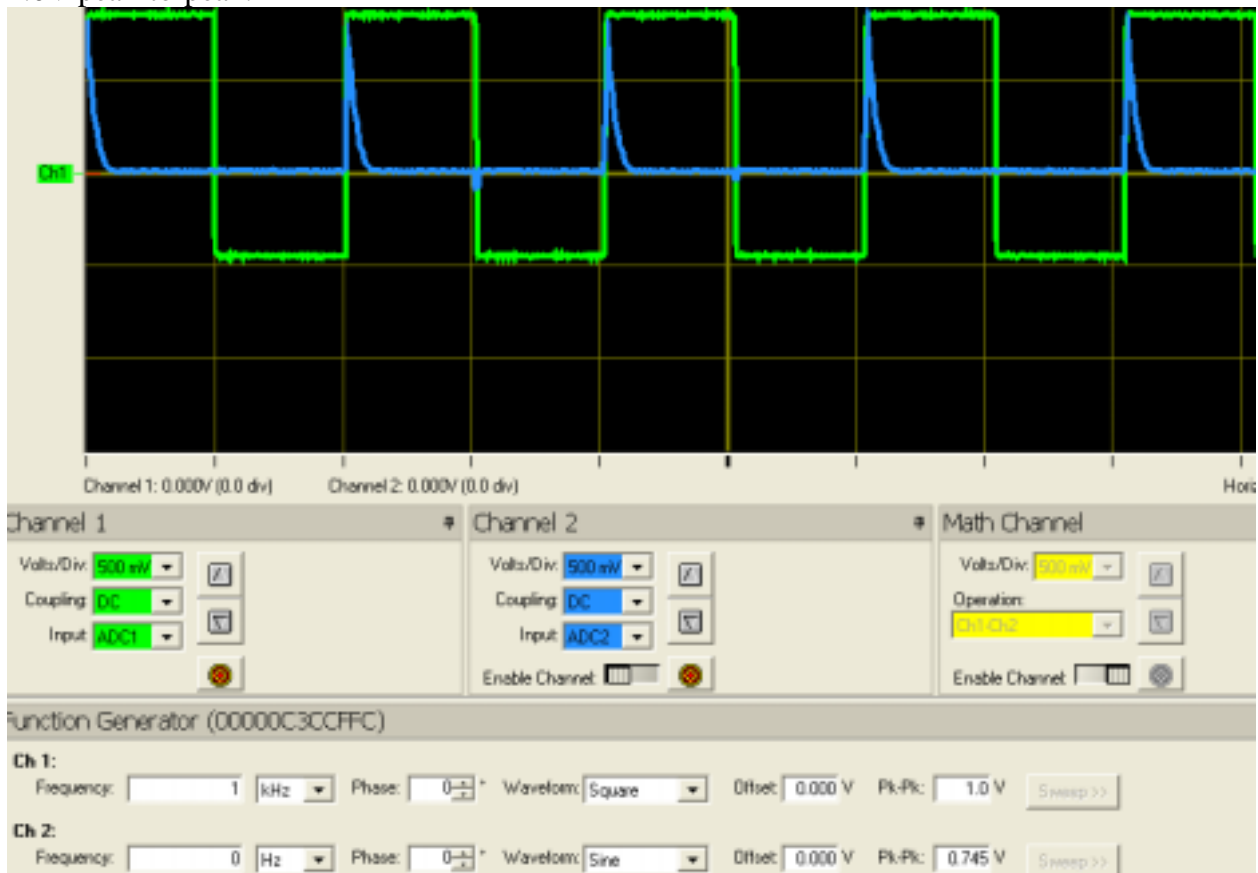
Click open the oscilloscope function and enable channel 2 so that we use both probes.

Then, click open the function generator function. Then the screen is horizontally arranged so that upper part is used for scope, and the lower part for function generator. To change values for the function generator, just type in desired numbers, or select a desired waveform. Make sure that the peak-to-peak does not go above 1.4 or so. To be in the safe side, type in 1.0. For the frequency part, type in any number until you have some weird distorted waveform. Take that as the limit.

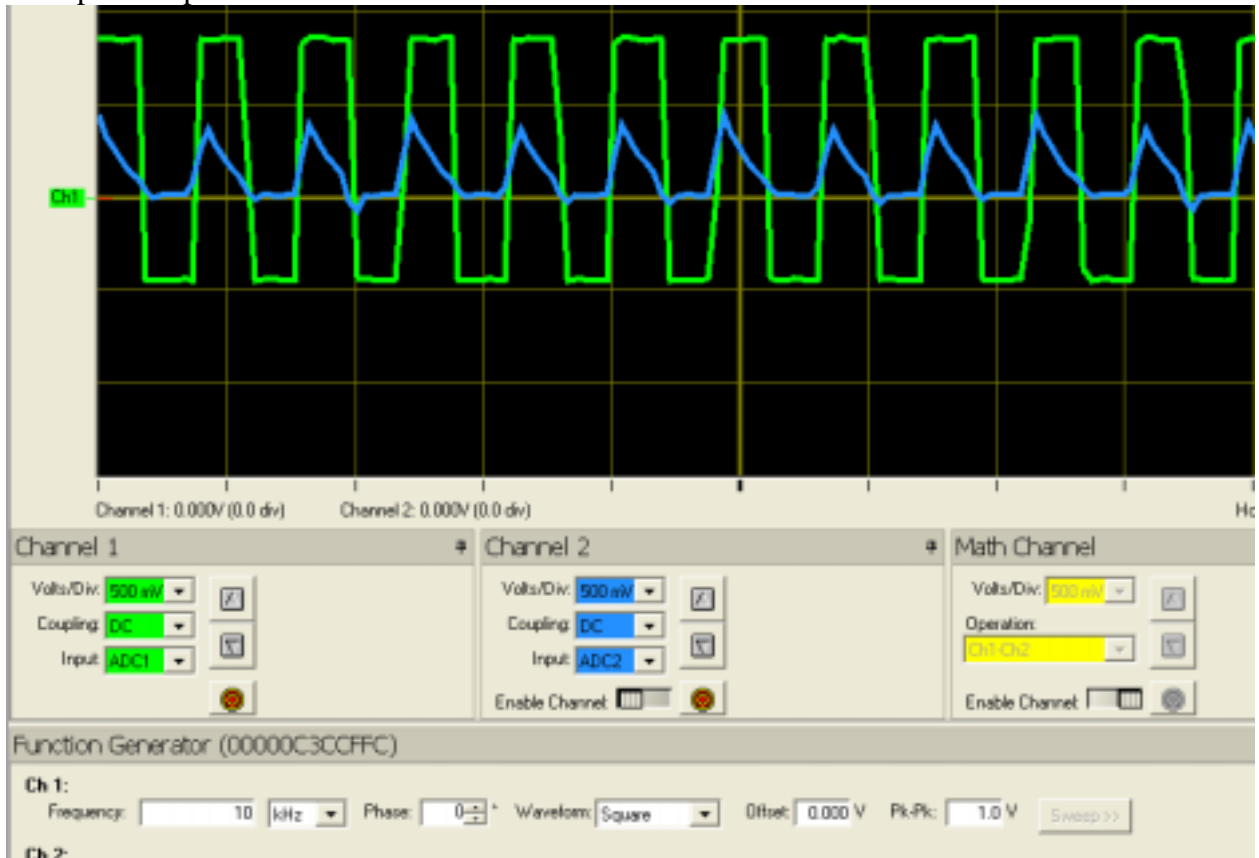
Below is the screen shot for scope and function generator 1 with 0.5kHz square waveform with 1.0V peak-to-peak.



Below is the screen shot for scope and function generator 1 with 1.0 kHz square waveform with 1.0V peak-to-peak.



Next is the screen shot for scope and function generator 1 with 10.0 kHz square waveform with 1.0V peak-to-peak.



The last is the screen shot for scope and function generator 1 with 40.0 kHz square (?) waveform with 1.0V peak-to-peak.

