EET 150
Introduction to EET
Lab Activity 8
Function Generator Introduction

Required Parts, Software and Equipment

Parts

Figure 1	
Component /Value	Quantity
Resistor 10 kΩ, ¼ Watt, 5% Tolerance	1
Resistor 22 kΩ, ¼ Watt, 5% Tolerance	1

Equipment

Required

On-Campus Students

Solderless Experimenters' Board
Hookup wire (22 AWG)
Wire cutter/stripper
Function Generator
Oscilloscope
10x Scope Probe
BNC-Alligator Leads cable

Optional

2 Banana jack leads red/black

On-Line Students

Analog Discovery 2: Arbitrary Waveform Generator (AWG). Two channel oscilloscope

Optional

BNC adapter board for Analog Discovery 2 Digilent 410-263
available at: http://store.digilentinc.com/bnc-adapter-board-for-the-analog-discovery/
1 BNC to alligator lead test cable
2 10x scope probes Digilent 460-004 or equivalent
available at: http://store.digilentinc.com/bnc-oscilloscope-x1-x10-probes-pair/
2 Banana jack leads red/black
BNC-Alligator Leads cable

Software

On-Campus Students

MS Word

On-Line Students

Waveforms 2015 for Analog Discovery 2
Available for download at : http://store.digilentinc.com/waveforms-2015-download-only/
MS Word

Introduction

Function generators are commonly used to supply different signals to circuits for testing and design purposes. The signal waveform can have various shapes, frequencies, and amplitudes. Students can use the function generator to inject a known signal into a system and see how it changes through the system. A designer can verify the circuit design by comparing the resulting waveforms to the expected results from circuit calculations and circuit simulations. A technician can troubleshoot circuit faults by tracing the path of the injected signal through the circuit until it is lost. In that way the fault can be isolated to a single stage of a multistage system.

Objective

The objective of this lab is to further students' knowledge of function generator usage. Students will be able to measure the peak voltage, period, and frequencies of different wave forms from the signal generator. Students will record the characteristics of the different waveforms.

Procedure:

1. Construct the circuit shown in Figure 1 below on the SEB.

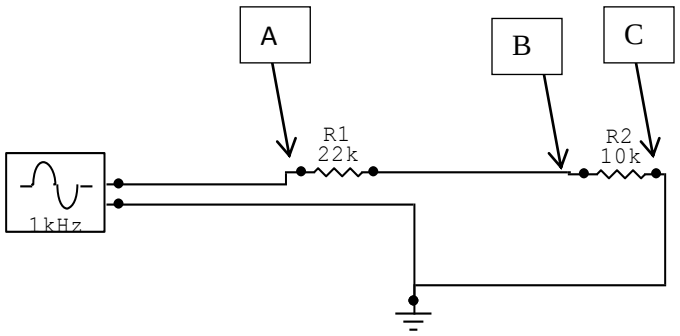


Figure 1. Test Circuit 1.

2. **On-Campus Students**: Set the function generators output impedance to high Z. Push the utility button, push the output button, and then select high Z.
   On-line Students: Setup the Analog Discovery 2 module according to the procedures shown in the video.
3. Set the output frequency to 1 kHz and amplitude to 200 mV peak-to-peak (p-p). Select the sine wave function from the function generator controls. Measure the resulting output with the oscilloscope.

   On-Campus Students: Sketch and measure manually the waveform from points A to C and from B to C. Use the graph pages and tables in Appendix A in the end of this handout to

document the measurements. Measure the peak-to-peak amplitude of the signal and its period. Compute the frequency from the measured period using the formula below.

$$f = \frac{1}{T}$$

Where: T = period in seconds (S)
f= frequency in Hertz (Hz)

Enter these measurements and calculations in Table 1 of Appendix A. Review presentation slides for the details of these measurements if necessary.

On-line Students: Use the scope input of the AD2 and the WaveForms 2015 software to display the scope output. Display the signal from points A to C and from points B to C. Export the WaveForms display for both measurements to Appendix B of the Word version of this document. Place the images in the space provided. See the tutorial video on exporting the display for more details. Use the AD2 and WaveForms scope measurement functions to find the, peak-to-peak amplitude, the signal period and frequency. Enter these measurements and calculations in Table 1 of Appendix B.

4. Adjust the function generator frequency to 10 kHz and amplitude to 250 mVp-p. Select the square wave function. Measure the resulting output with the oscilloscope.

   On-Campus Students: Sketch and measure manually the waveform from points A to C and from B to C. Use the graph pages and tables in Appendix A at the end of this handout to document the measurements. Measure the peak-to-peak amplitude of the signal and its period. Compute the frequency from the measured period using the formula from step 3. Enter these measurements and calculations in Table 2 of Appendix A.

   On-line Students: Use the scope input of the AD2 and the WaveForms 2015 software to display the scope output. Display the signal from points A to C and from points B to C. Export the WaveForms display for both measurements to Appendix B of the Word version of this document. Place the images in the space provided. See the tutorial video on exporting the display for more details. Use the AD2 and WaveForms scope measurement functions to find the, peak-to-peak amplitude, the signal period and frequency. Enter these measurements and calculations in Table 2 of Appendix B.

5. Adjust the frequency to 100 Hz and amplitude to 100 mVp-p. Select the triangle wave function. Measure the resulting output with the oscilloscope.

   On-Campus Students: Sketch and measure manually the waveform from points A to C and from B to C. Use the graph pages and tables in Appendix A end of this handout to

document the measurements. Measure the peak-to-peak amplitude of the signal and its period. Compute the frequency from the measured period using the formula from step 3. Enter these measurements and calculations in Table 3 of Appendix A.

On-line Students: Use the scope input of the AD2 and the WaveForms 2015 software to display the scope output. Display the signal from points A to C and from points B to C. Export the WaveForms display for both measurements to Appendix B of the Word version of this document. Place the images in the space provided. See the tutorial video on exporting the display for more details. Use the AD2 and WaveForms scope measurement functions to find the, peak-to-peak amplitude, the signal period and frequency. Enter these measurements and calculations in Table 3 of Appendix B.

Discussion Points

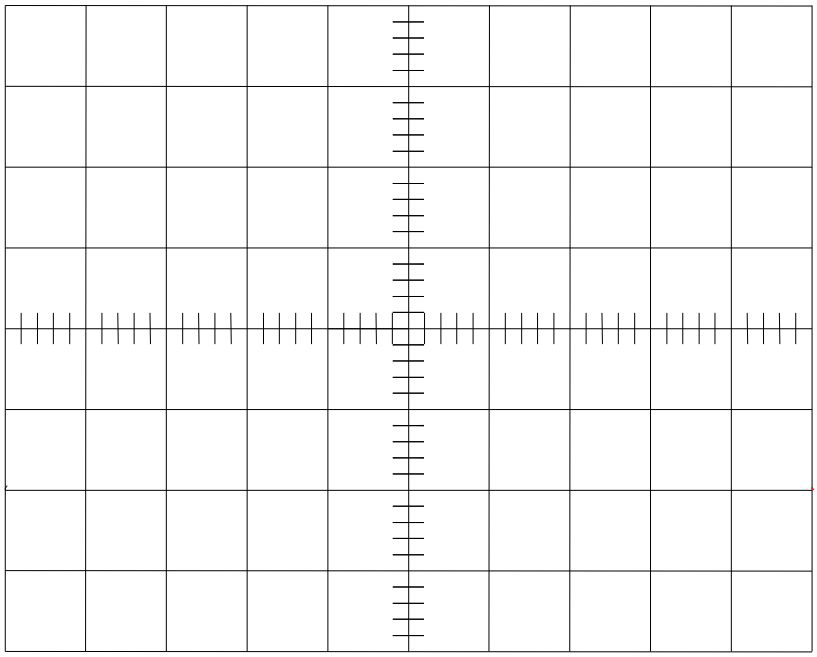
Describe the different wave functions of the function generator.

Appendix A
On-campus Student Measurements and Graphs

Table 1 - Sine Wave Measurements

Test Points	Voltage (Vpp)	Period (Seconds)	Frequency (Hz)
A-C			
B-C			

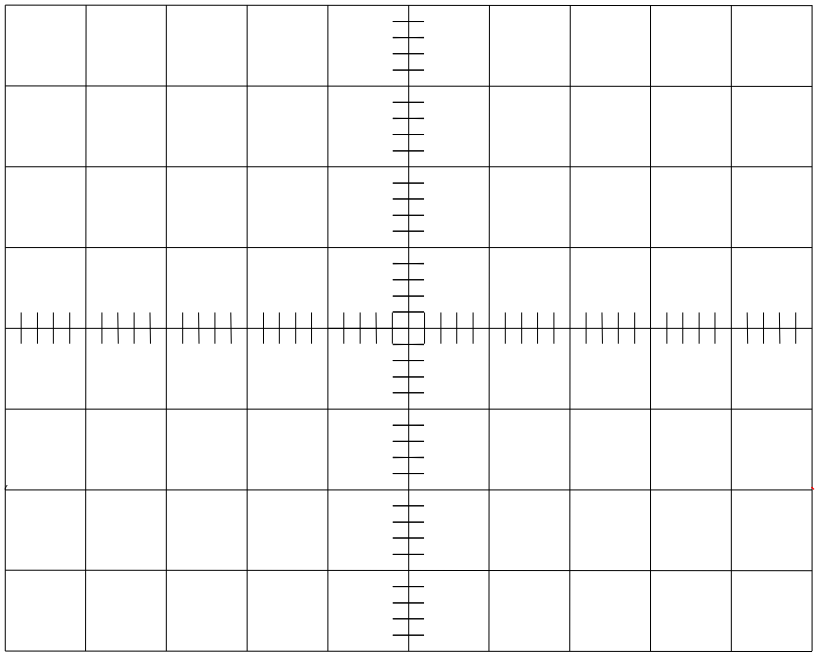
Sine Wave Sketch A-C



Channel 1 Volts/div _____ Channel 2 Volts/div _____ Time/div _____

Appendix A
On-campus Student Measurements and Graphs

Sine Wave Sketch B-C



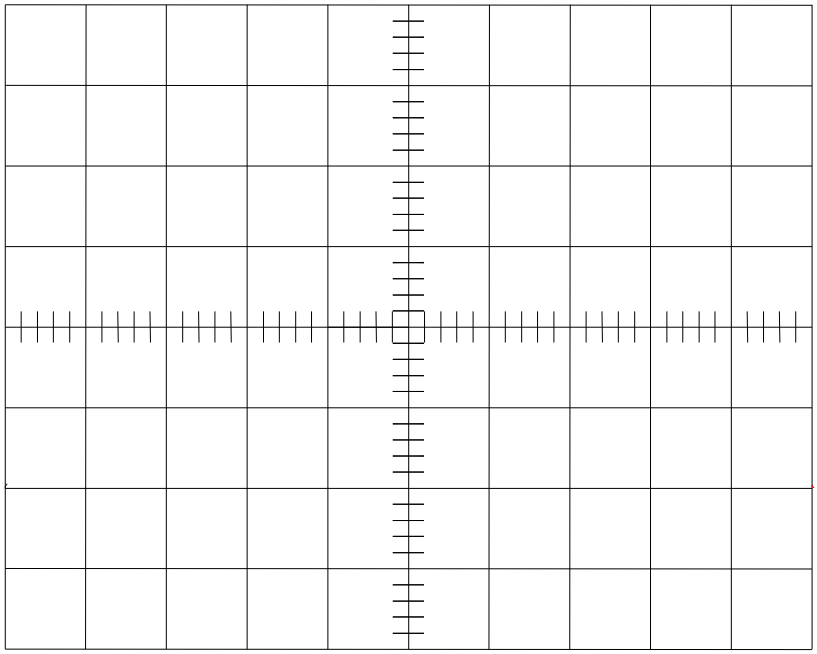
Channel 1 Volts/div _____ Channel 2 Volts/div _____ Time/div _____

Appendix A
On-campus Student Measurements and Graphs

Table 2 - Square Wave Measurements

Test Points	Voltage (Vpp)	Period (Seconds)	Frequency (Hz)
A-C			
B-C			

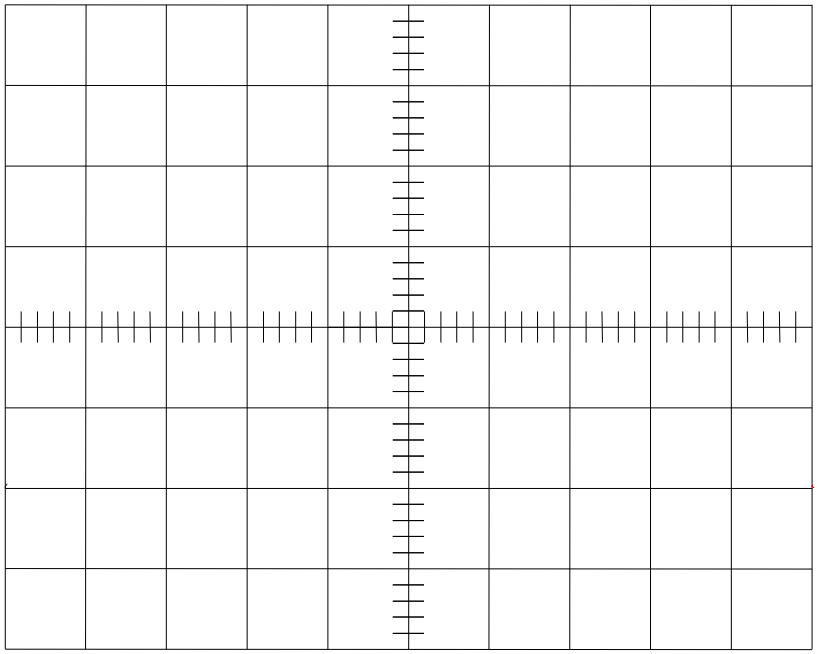
Square Wave Sketch A-C



Channel 1 Volts/div _____ Channel 2 Volts/div _____ Time/div _____

Appendix A
On-campus Student Measurements and Graphs

Square Wave Sketch B-C



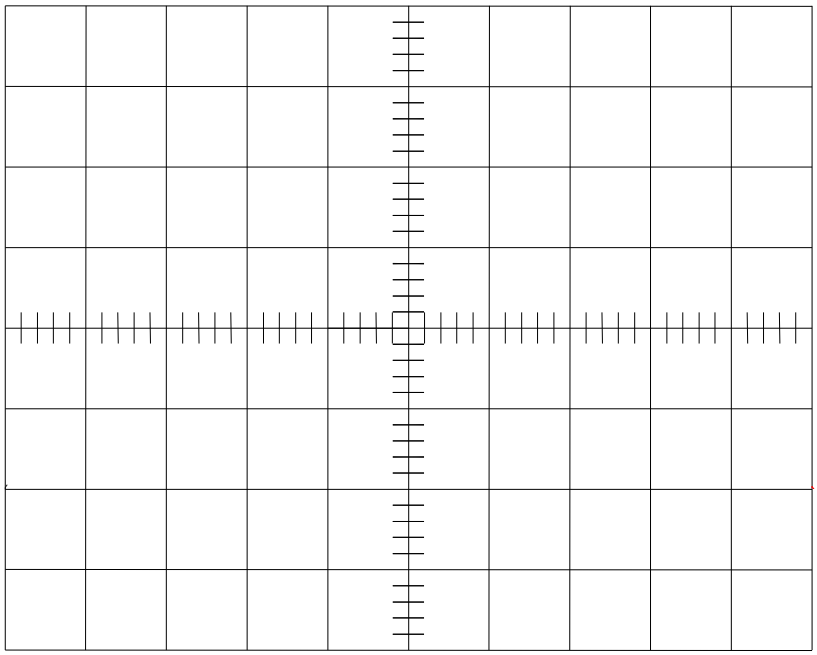
Channel 1 Volts/div _____ Channel 2 Volts/div _____ Time/div _____

Appendix A
On-campus Student Measurements and Graphs

Table 3 - Triangle Wave Measurements

Test Points	Voltage (Vpp)	Period (Seconds)	Frequency (Hz)
A-C			
B-C			

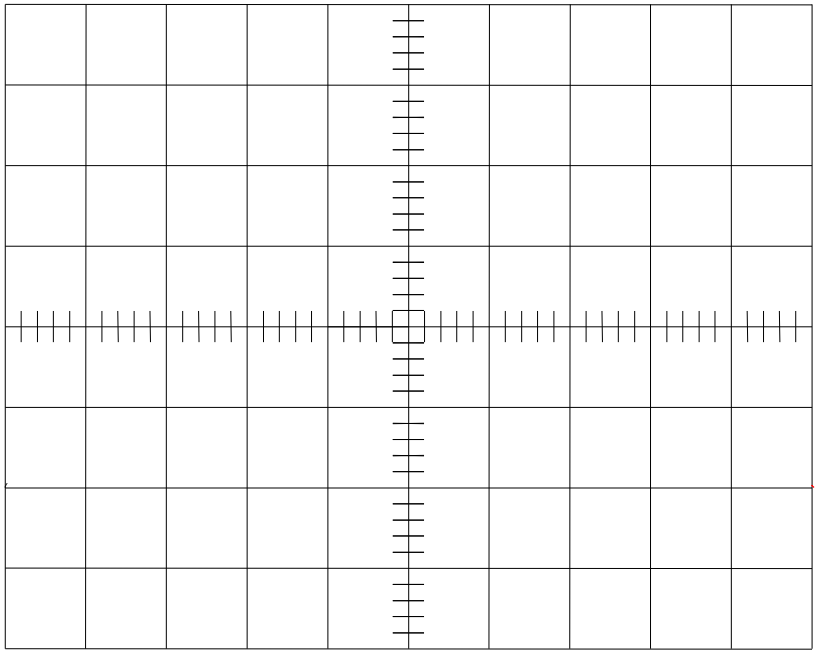
Triangle Wave Sketch A-C



Channel 1 Volts/div _____ Channel 2 Volts/div _____ Time/div _____

Appendix A
On-campus Student Measurements and Graphs

Triangle Wave Sketch B-C



Channel 1 Volts/div _____ Channel 2 Volts/div _____ Time/div _____

Appendix B
On-Line Student Measurements and Graphs

Table 1 - Sine Wave Measurements

Test Points	Voltage (Vpp)	Period (Seconds)	Frequency (Hz)
A-C			
B-C			

Sine Wave Scope Measurement A-C

Remove this box and add the scope plot from Waveforms

Appendix B
On-Line Student Measurements and Graphs

Sine Wave Scope Measurement B-C

Remove this box and add the scope plot from Waveforms

Appendix B
On-Line Student Measurements and Graphs

Table 2 - Square Wave Measurements

Test Points	Voltage (Vpp)	Period (Seconds)	Frequency (Hz)
A-C			
B-C			

Square Wave Scope Measurement A-C

Remove this box and add the scope plot from Waveforms

Appendix B
On-Line Student Measurements and Graphs

Square Wave Scope Measurement B-C

Remove this box and add the scope plot from Waveforms

Appendix B
On-Line Student Measurements and Graphs

Table 3 - Triangle Wave Measurements

Test Points	Voltage (Vpp)	Period (Seconds)	Frequency (Hz)
A-C			
B-C			

Triangle Wave Scope Measurement A-C

Remove this box and add the scope plot from Waveforms

Appendix B
On-Line Student Measurements and Graphs

Triangle Wave Scope Measurement B-C

Remove this box and add the scope plot from Waveforms