

Arbitrary Waveform Generators

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Purpose:

The objective of this experiment is to introduce the student to the capabilities of arbitrary waveform generators and remote operation via computers.

Equipment:

- HP 54600B Oscilloscope
- HP 33120A Function/ARB Generator
- HP BenchLink/Suite Software

Arbitrary waveform generators permit the user to design and generate virtually any waveform in addition to the standard function generator signals (e.g. sine wave, square wave, etc.).

In this laboratory exercise, we will explore the capabilities of the HP 33120A Function Generator/Arbitrary Waveform Generator. This instrument has the capability of outputting sine, square, ramp, and sawtooth waveforms as well as arbitrary waveforms. Several arbitrary waveforms have been built in to the instrument including the sinc function, a negative ramp, an exponential rise, an exponential fall, and a cardiac signal. The waveforms can be modulated using amplitude, burst, frequency or frequency shift key modulation.

Stand Alone Operation:

1. Connect the output of the HP 33120A to the oscilloscope channel 1.
2. To familiarize yourself with many of the features of the instrument, go through the tutorial outlined in Section 2 of the user manual. Sketch the AM modulated waveform from the oscilloscope. Use the single trigger mode on the oscilloscope if it is necessary to get a stable display.
3. Press the blue **Shift** key followed by the **Arb** key to enter the **arb list** menu. Use the > key to display the **SINC** menu item. Press the **Enter** key to select the sinc function as an arbitrary waveform for output from the instrument. Use the single trigger mode of the oscilloscope to display the waveform.
4. Repeat Step 3 for the negative ramp, exponential rise, exponential fall, and cardiac waveforms. Sketch the cardiac waveform.

Remote Operation:

5. Click on the **BenchLink Arb** icon in the Windows Program Manager.



6. You now have the opportunity to use the library waveforms shown as icons (i.e., sine, ramp, square, etc.) or to draw an arbitrary waveform either free-hand or using straight line segments (see the **Waveforms** menu for all of these options).
 - A. Draw a **Freehand** sketch waveform. Click on **I/O** and **Send Waveform....** To download the waveform to the instrument from the computer.
 - B. Repeat Step A this time using the **Line** draw mode.
 - C. Repeat Step A this time using at least two of the library waveforms as portions of the same signal.

7. Determine how to use BenchLink Scope to download a waveform to the computer and BenchLink Arb to modify the waveform and download the waveform to the function generator. Write the procedure down and demonstrate it to the instructor.

References:

Bell, D. A., 1994, *Electronic Instrumentation and Measurements, 2nd Edition*, chapter 11.
Hewlett-Packard HP 33120A Function Generator/Arbitrary Waveform Generator User's Guide

