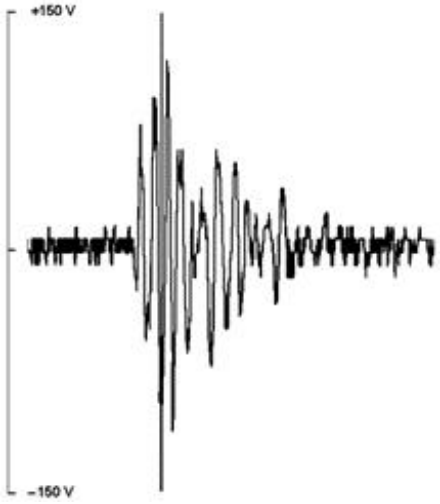
Electronic Instrumentation

Name _____ ENGR-4300 Fall 2000 Section _____

Practical Quiz #2
Noise Measurement

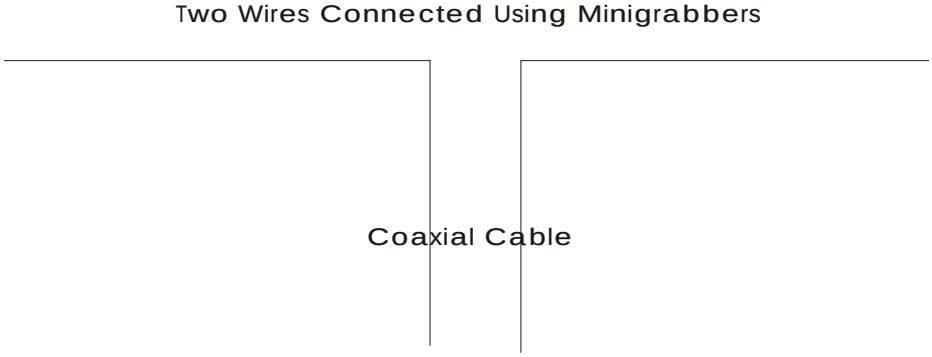
Key Tasks: (1) Identify three types of electrical noise that can appear on any data taken in the studio. Such noise can make interpretation of data difficult. (2) Set up oscilloscope to observe voltage signals when little *a priori* information is known about the signals.

Electrical Noise: It is a common problem in electrical systems, particularly those found in automobiles or aircraft, to find *extra* signals on power and signal lines that would not be there in an ideal world. These *extra* signals are called noise. A typical example of such noise is the transient signal observed on the power lines of an automobile when a horn is sounded. The voltage on these lines should be a constant value of 12 volts, but large transients can occur due to the horn, which can look like the figure below:



It is very important that we learn to recognize and characterize such noise sources so that whatever electrical systems we are using can operate in spite of them.

Experimental Set Up: The apparatus to be used for this question is very simple. Connect one of the BNC cables to channel 1 of your oscilloscope. Place a BNC-Minigrabber adapter on the end of the BNC cable. Connect the two red minigrabber cables together and then connect them to the red minigrabber lead on the BNC cable. Do the same for the two black minigrabber cables and the black minigrabber lead on the BNC cable. This gives you more than a foot of unshielded wires at the end of your cable. Spread the leads out forming a Tee with the BNC cable. This is now an antenna that you will use to measure electrical noise. You may recognize that it is similar to the antenna on your stereo receiver. Turn on all of the power supplies, the function generator, and the multimeter.



Find and capture on your scope (1) a noise signal in the range from 0 Hz through the middle of the audio frequencies (about 10kHz), (2) a noise signal in the range from about 20kHz to 100kHz and (3) a high frequency noise signal (much higher than 100kHz but less than 100MHz). *Note that the oscilloscopes we use can accurately measure up to 100MHz when they are AC Coupled. Thus, you should select AC coupling when you attempt the higher frequency measurement.* You will have to search around a bit until you can find something reasonably distinctive. Once you have found a signal and captured it on the 'scope, print a copy of your signal using HP Benchlink and draw a simple sketch or describe where the wires were located when this signal was the largest. Was your antenna near a computer, a power supply, vertical, horizontal, etc. In the space provided below, write down the number on the HP computer connected to your 'scope. Determine the approximate frequencies of these signals. After you print out your results, show them to a TA or instructor.

Do you have any idea what the source of these noise signals might be? Are any of your noise signals produced by electrical power lines? You have to provide some kind of an explanation to get credit for this.

The HP computer connected to the 'scope used is computer number _____.

Show your results to a TA or instructor and have them sign this sheet below.

TA/Instructor _____ Passed _____ Not Passed _____ Date _____