

# Minilab 0—Equipment and Software

## Purpose

Labs give you a view of the physical world that we learn about in class in the abstract. In these ten Minilabs, you'll try out some of what we do in class. Our tools for most Minilabs will be a simple digital multimeter (DMM) and Mobile Studio Desktop™ (MSD).

Mobile Studio Desktop provides the equivalent of a number of bench-top electrical instruments in the form of software on a personal computer. The purpose of this Introduction is to tell you a little about MSD, walk you through setting it up on your laptop, and have you try a couple of its functions.

## A Brief History

Mobile Studio Desktop grew out of an idea of Professor Don Millard, an idea that good electrical laboratory pedagogy could be accomplished by using computer representations of typical laboratory instruments plus computer interface boards to connect to actual electrical devices and circuits.

Professor Millard and his graduate students began to develop this idea at Rensselaer Polytechnic Institute. As the project expanded, he obtained financial support from the National Science Foundation and involved four other schools: Howard, Morgan State, Rose-Hulman, and SUNY Albany.

The concept is simple: Use a computer as the instrument, provide an interface board to connect electrical devices to the computer thru the USB port, and manipulate the virtual instruments just as one would when using real instruments on a lab bench—but at a much lower cost. Figure 1 shows a complete set-up with a small circuit attached to it.

## Equipment

You'll need a number of items to be able to execute the laboratory exercises in this series:

- An Intel-based computer, either desktop or laptop with a USB 2.0 port, running Windows 2000, XP (except x64), Vista, or Windows 7. This includes Intel-based Macs running Windows either under OS X and Parallels or stand-alone via Boot Camp.<sup>1</sup>

<sup>1</sup> I have not been successful on the Mac with Fusion or VirtualBox. Parallels is slow.

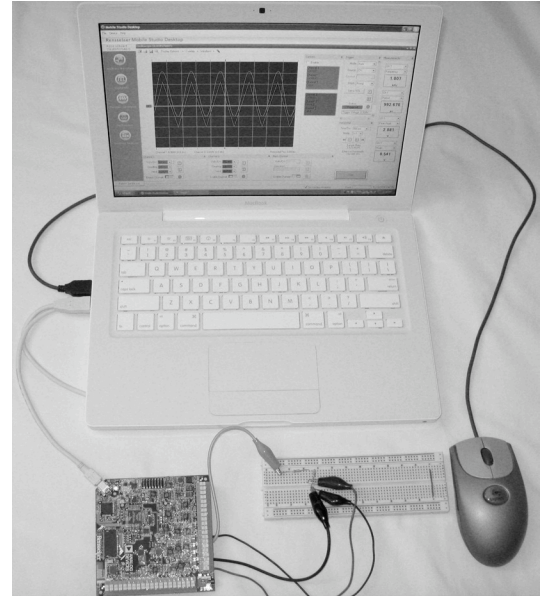


Fig. 1—Complete MSD setup

- The current version of Mobile Studio Desktop. See the next section for how to get this.
- The current Mobile Studio IOBoard™ and the appropriate USB cable.
- A 3-V (nominal) battery supply (Fig. 2).
- A dual 6-V (nominal) battery supply (Fig. 3).
- A standard breadboard for building circuits.
- A collection of resistors, capacitors, and inductors.
- A digital multimeter (DMM) for many different

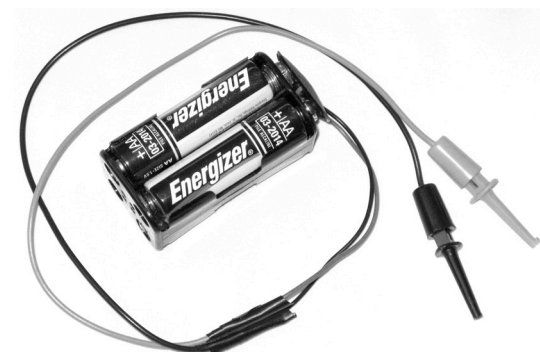


Fig. 2—3-V (nominal) supply

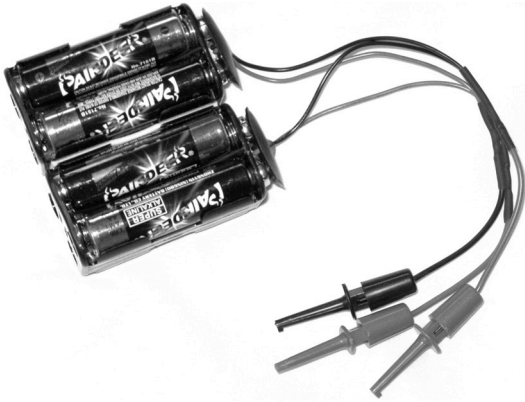


Fig. 3—Dual 6-V (nominal) supply

measurements. The Tenma model pictured (Fig. 4) is a “3¾ digit” DMM for under \$20.

Each Minilab will state at the beginning the parts and equipment needed to carry out the work.

A word of warning! The I/O boards are powered by your computer’s USB port. The circuits you build will be connected to the board and will derive power from it. DON’T SHORT-CIRCUIT ANY POWER CONNECTIONS FROM THE I/O BOARD! It is possible to destroy the board and, under the right (wrong?) conditions, your USB port.

## Installing Mobile Studio Desktop

Before downloading Mobile Studio Desktop, YOU MUST DISCONNECT ANY I/O BOARD FROM YOUR USB PORT. Don’t connect the board until you have MSD running on your computer.

You *must* be in administrator Mode. Then go to <http://www.mobilestudioproject.com> and click on the “Software Download” button.

After downloading, go through the license and installer screens. If you get a security warning, allow installation to continue. If you are asked to allow installation of .NET or National Instrument software, allow them because they are needed for MSD to run.

## Connecting the I/O Board

Once installation is finished, and you are still in *administrator mode*, connect your I/O board. If you get a notice of a

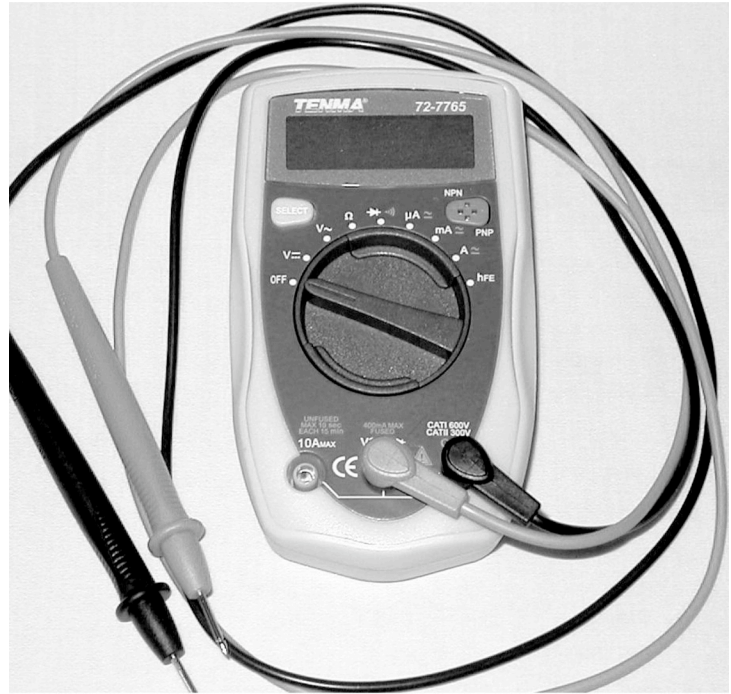


Fig. 4—Digital multimeter

need for drivers, follow the Add New Hardware instructions, accepting all defaults. You also may get a request to update the board’s firmware before the board will work properly. Go to the Device menu and follow instructions.

## Now Let’s Play!

You’ve installed your software and connected your I/O board, so let’s play with a couple of instruments without connecting anything to the I/O Board.

I’m going to walk you through some simple exercises to try out the instruments. I’ll use a few screen shots, but don’t be surprised if your screen differs a bit from mine. The MSD software is continually being updated and screens change from time to time.

I’ll assume that you have MSD running, an I/O board connected, and a display of icons for several instruments on the left. We’ll start with the Function Generator.

### Function Generator

1. Click on the FUNCTION GENERATOR icon.

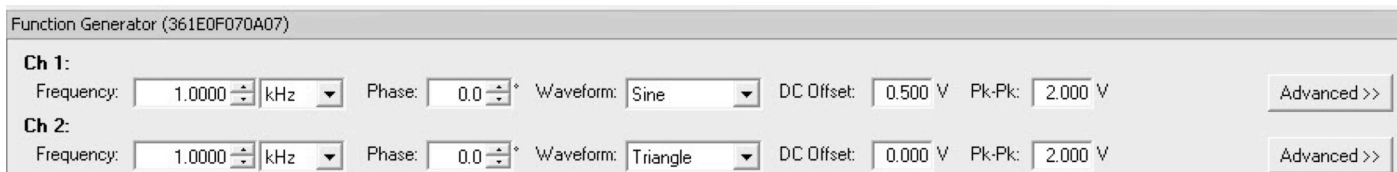


Fig. 5—Function generator screen

2. Change the settings for Ch 1 and Ch 2 to match those shown in Fig. 5.
3. Note that Ch 1 has a d-c offset of 0.5 V and Ch 2 is a triangle waveform.
4. Locate the small pushpin in the upper right corner and click on it to get the Function Generator to become a tab near the bottom of the screen.
5. Mouse over the Function Generator tab at the bottom of the working area and note that the settings pop up. Moving the mouse out of the Function Generator sinks them from sight.

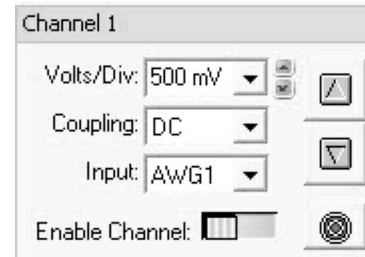


Fig. 6—Scope channel screen

**Oscilloscope**

1. Click on the OSCILLOSCOPE icon.
2. Set up Channel 1 to 500 mV, DC coupling, and AWG1 input. (AWG1 is both the Arbitrary Waveform Generator and also the Function Generator.) See Fig. 6.
3. Enable the channel by clicking the switch to the left.

4. Set up and enable Channel 2 the same way, except that the input is to be AWG2.
5. Click on the red Start button near the bottom right of the screen

Your MSD screen should look like Fig. 7.

**The End**

Now you have Mobile Studio Desktop set up to begin the various laboratory exercises.

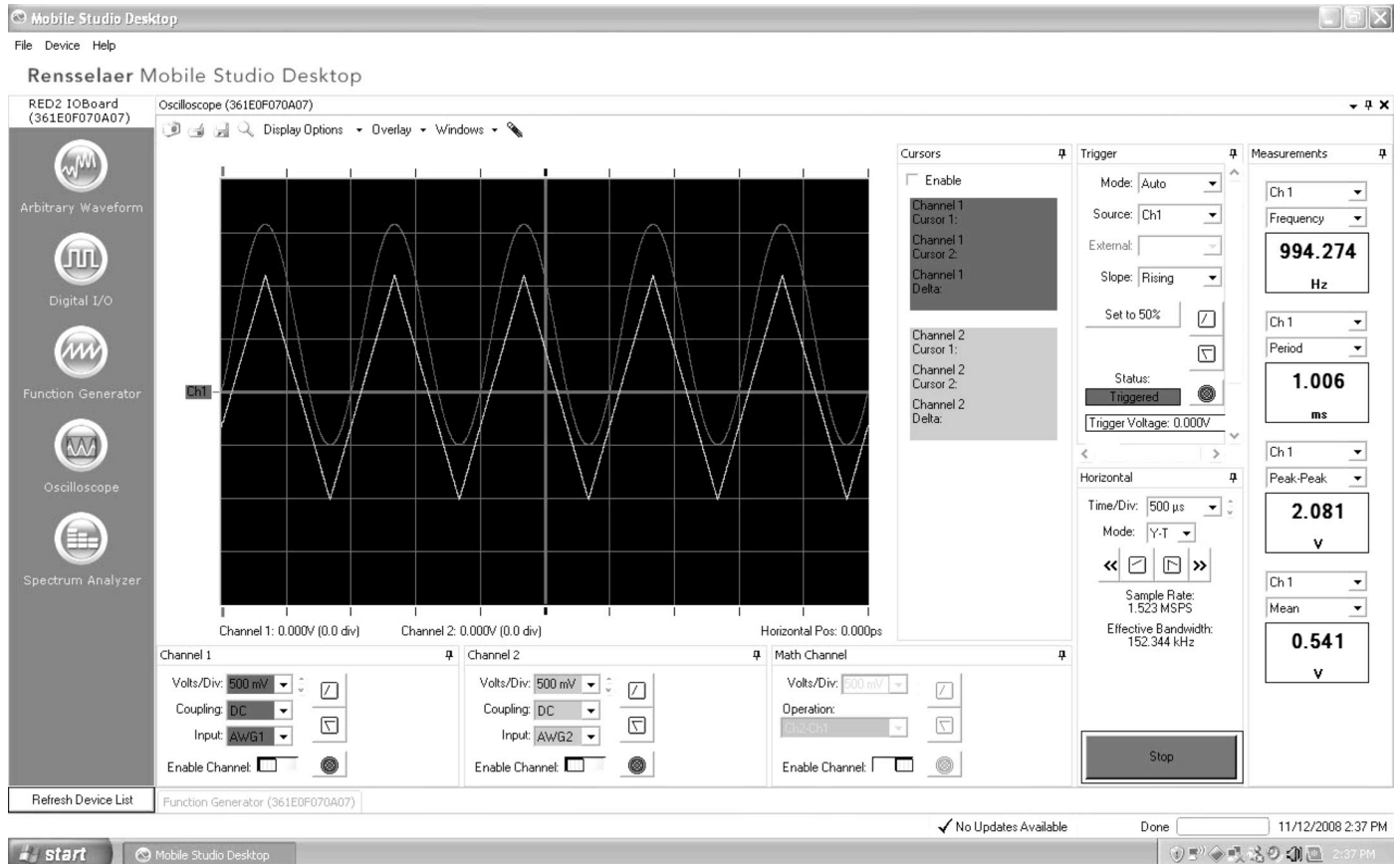


Fig. 7—Overall MSD screen