

# Physics 309 Handout 1

## Hebb 42 Personal Computers

### Lab Bench Setup

The computer has an analog/digital converter (ADC) card with 8 analog voltage inputs, 2 analog voltage outputs, 8 digital input bits, 8 digital output bits, and digital trigger and gate bits.

The flat gold box with a clear plastic top and 13 coaxial cable connectors is the interface to the ADC card. It also has an external power supply. The ADC card interface is on top of a silver box containing an RMS to DC converter (not used in all experiments).

Underneath the center of the shelf is a signal generator, manual-controlled.

To the left of the signal generator there is an oscilloscope.

### Computer Overview

**Always shut the system down cleanly rather than just killing the power.**

Unlike the Hennings 202-205 computer labs you may be used to, each computer here is stand-alone, with a separate disk and home directory. When you acquire data or do anything here, it is NOT automatically in your home directory on Physics. In addition, the same home directory is used by all 3 lab sessions (Monday, Tuesday, and Wednesday). Therefore, it is possible for your data to be moved or deleted.

**Make your on directory on the computer desktop, and save all your files in there.** You will be fully responsible of its content, management, and backup on other storage media. **You should transfer your data to your account at [physics.ubc.ca](http://physics.ubc.ca), and/or to your own personal memory stick, before leaving the lab.** Even before that, since it is so easy to overwrite or delete data yourself accidentally. **Do not rely on the computer to store your data between lab sessions!** Remember that three sessions share the same lab and computers, so your data could accidentally or intentionally be erased or overwritten. **We do not back up the files, so if it is gone, it is gone.**

## Starting up

If the computer is not on when you arrive, turn on the power bar on top of the wooden panel at the back of the lab bench. If that does not work, ask the TA to turn on the circuit breaker in the front of the room.

## Analog to Digital Converter Details

The analog-to-digital-converter (ADC) in the computer has a range of  $\pm 5$  volts mapped to 0-4095 (12 bits). Thus,  $-5$  volts at the ADC input gives 0 in the raw data, zero volts gives 2048, and  $+5$  volts gives 4095.

The interface box has buffer amplifiers, so the voltage at the ADC is different from the voltage at the coax connector. Channels 0 and 1 have gain=5, channels 2 and 3 have gain=2, channels 4 and 5 have gain=1, channels 6 and 7 have gain=0.5.

A raw ADC value of 2048 always corresponds to zero volts, but 1 ADC count means  $1/2048$  volts for channels 0 and 1,  $5/4096$  volts for channels 2 and 3,  $5/2048$  volts for channels 4 and 5, and  $10/2048$  volts for channels 6 and 7.

The software for the ADC needs to be told which channels to read, then does the appropriate gain and offset correction to return a reading in volts.

There are not actually 8 ADCs on the card; there is a single ADC with an analog multiplexer (8-way switch). Therefore, it is not possible to read more than 1 channel at the same time; the minimum delay between channels is 33 microseconds.

Also, the maximum rate that a single channel can be read is about once every 33 microseconds, even if you ask for faster sampling.

If the sampling time is very long, more than 15000 microseconds (15 milliseconds), then the time is rounded to the nearest 10 milliseconds, meaning 15 to 25 milliseconds will become 20 milliseconds; 25-35 will become 30 milliseconds, etc.