Protocol 1: Introduction to Data Acquisition

The purpose of the PowerLab system is to acquire, store, and analyze data. Physiological measurements that we will collect include the finger pulse, blood pressure, respiration, and even more complicated measurements like an ECG (heart), EMG (muscle), EEG (brain waves), nerve conduction. We connect instruments called “transducers” to the PowerLab to measure changes on the body such as pressure, temperature, motion, volume changes, voltage, etc. The raw input signal from the transducer is in the form of an analog voltage whose amplitude varies continuously over time.

One of our main concerns in physiological recording is getting a good signal through the background electrical noise. There are many sources of noise which obscure the signal: unwanted voltage signal from movements, shaking, building vibration, overhead lights and stray electricity, etc. In addition, in some experiments there may be drift in the signal (the baseline slowly changing through time).

The PowerLab can be used for *signal conditioning:* producing a good signal through amplification, filtering, and zeroing (removing an unwanted steady offset voltage from a transducer’s output). After signal conditioning, the analog voltage is sampled at regular intervals, and converted from analog to digital form in order to save it on the attached computer (Figure 1). The software can also easily manipulate and analyze the data in a variety of ways.

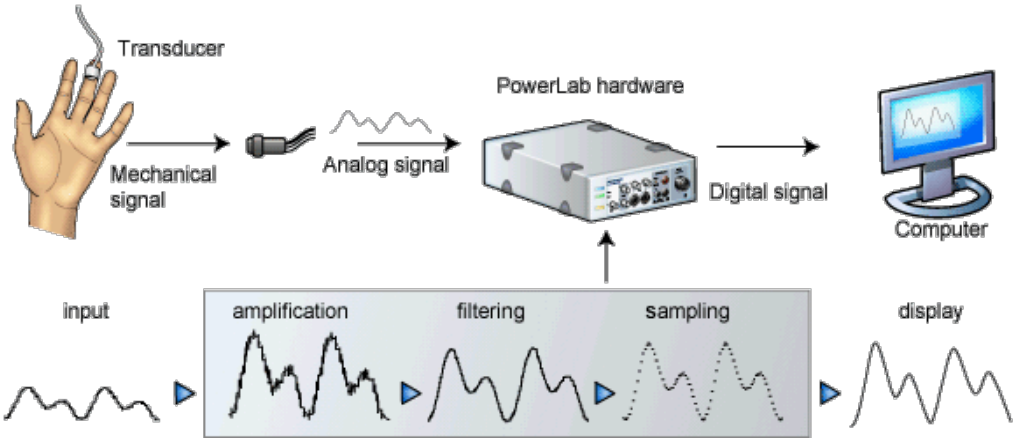
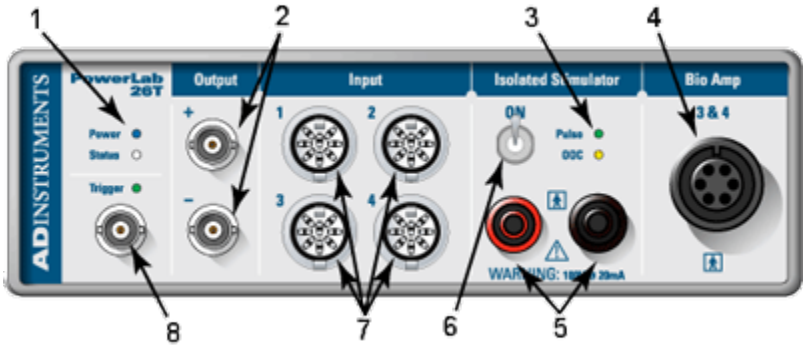


Figure 1. A summary of data acquisition using a PowerLab system.

The 4-channel PowerLab has inputs on its front panel where transducers can be connected. Note that only one input port can be used per channel. It can also generate output signals. We have 3 different PowerLab models in the lab, so yours might look slightly different, but they all work the same. The front of PowerLab 26T and 4/25 (red and blue versions) are shown in Figure 2.



1. Power indicator light: illuminates when the PowerLab is turned on
2. Analog output connections: provide a voltage output in the 10 V range
   ⚠This is NOT safe for direct connection to humans
3. Isolated Stimulator status light: indicates if the Isolated Stimulator is working properly (green) or out of compliance (yellow)
4. Dual Bio Amp input: connects a 5 lead Bio Amp cable to the PowerLab; reads as inputs 3 and 4
5. Isolated Stimulator outputs: for connecting stimulating electrodes to the Isolated Stimulator
6. Isolated Stimulator switch: turns on/off the Isolated Stimulator
7. Pod ports: 8-pin connectors for attaching pods and certain transducers to Input; these supply a DC Power to the pods and transducers
8. Trigger input: can be used to start or stop a recording event

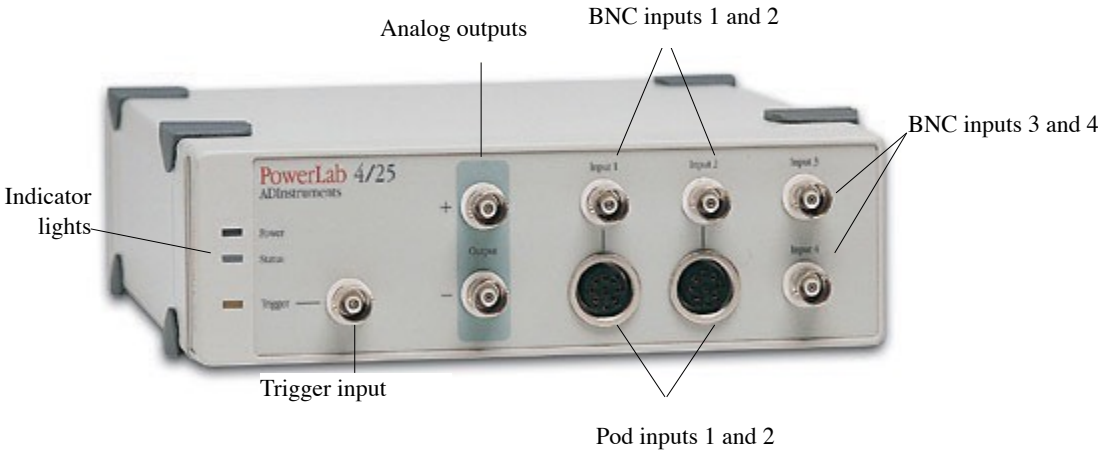


Figure 2. The front panel of the PowerLab 26T (top) and 4/25 (bottom). The look a little different but serve the same functions. We have 2 versions of 4/25 - red letter or blue letter models.

The Chart software controls the PowerLab hardware. The display format resembles a traditional chart recorder, with a scrolling area of the window acting as the paper.

Protocol 1.1: PowerLab Setup

1. Connect the PowerLab to the computer via the USB cable and connect the power cable to power. Turn on the PowerLab so that when you start the Lab Chart software, the computer will be able to detect the unit.

2. Start the Lab Chart software. The chart window is divided into a number of recording channels. By default the blank Chart window will show 8 channels.

3. Another way to start Lab Chart is double clicking on a settings file. The Physiology Lab folder on the desktop contains settings for our experiments. The Chart will be configured for the proper number of channels and with the appropriate settings for specific kinds of recording.

4. When your experiment is complete, be sure to save your raw data as a "chart data" file (a text file).

Protocol 1.2: Finger Pulse Transducer Setup

1. Connect the finger pulse transducer to Input 1 on the PowerLab. On the 26T it will be a

pod connector, on the 4/25 it will be a BNC connector.

2. Place the pressure pad of the finger pulse transducer against the distal segment (the tip) of the middle finger. Use the Velcro strap to attach it just enough so that it won't slip or fall (Fig. 1). This is a sensitive mechanical transducer so do not squeeze or press it.

If the strap is too loose, the signal will be weak, intermittent, or noisy. If the strap is too tight, this will cut off blood flow to the finger, producing no signal and pain.

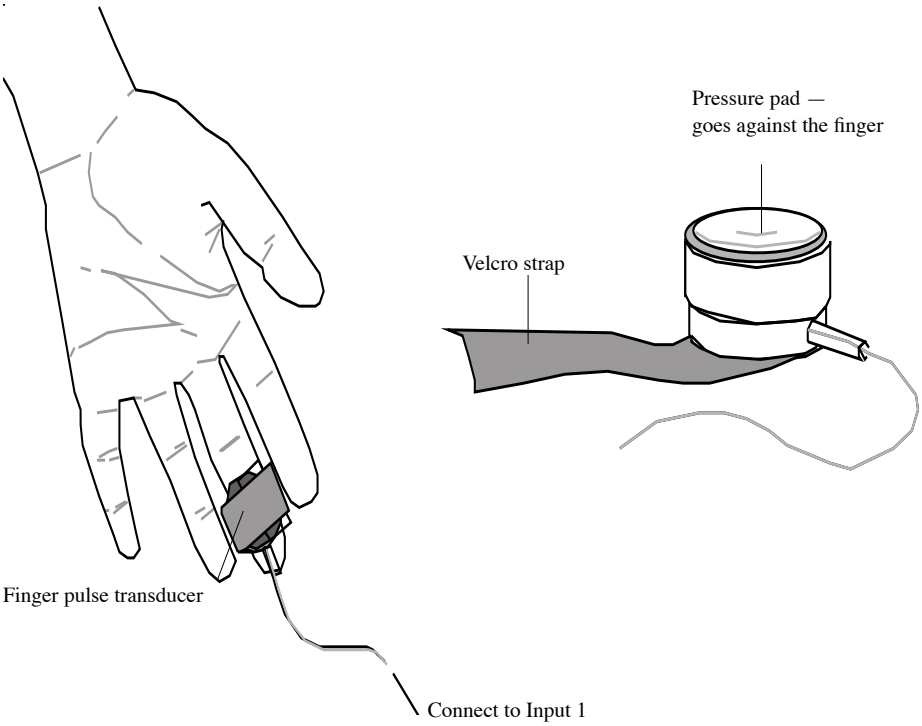
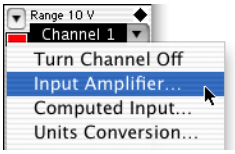


Figure 1. Connecting the finger pulse transducer to the PowerLab and the finger.

Use the Input Amplifier dialog box to optimally display signal

IMPORTANT: If you have the display range set to values inappropriate for your signal, you may not be able to see your signal at all. For example, measuring the diameter of your hair with a meter stick will not be very accurate – you'll get a much better measurement if you match the scale of the ruler to the hair.



1. Find the pop-up menu from the Channel label. Choose **Input Amplifier**.

2. Adjust the sensitivity of the channel by changing the range setting. The number indicates the maximum input voltage (i.e., the 10 V indicates ±10 V). Try a number of ranges to find

a nice waveform that fills about a third of the window (Figure 2). Did the signal change in magnitude?

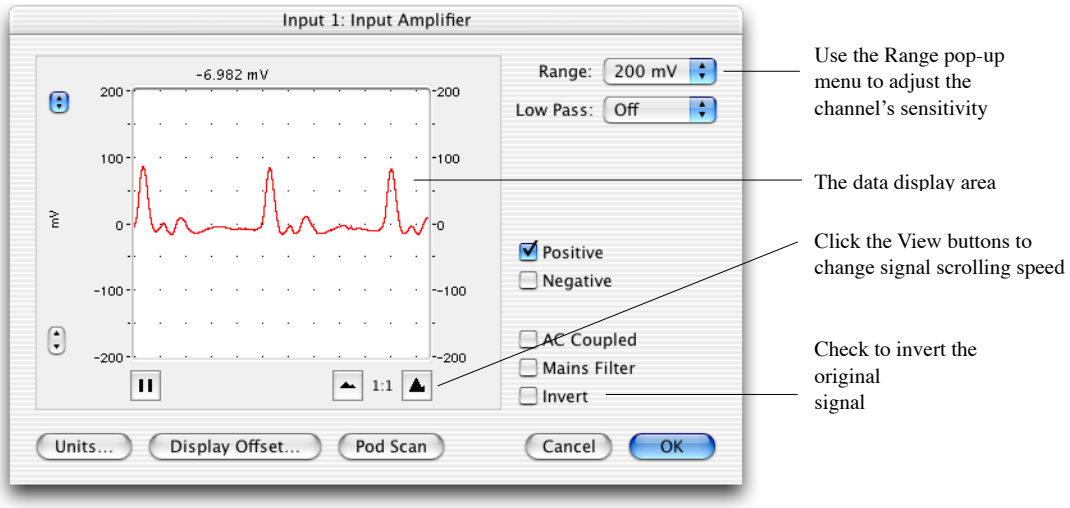


Figure 2. The Input Amplifier dialog box.

Protocol 1.3: Saving Data

Save the data to Text files for Excel or later analysis

You may use Google Sheets or Microsoft Excel to analyze data, graph results, or produce statistical results, or any software packages of your choice.

Save as "Chart data" to save the raw data (the entire chart record) as a text file. The other option is just to save the contents of the data pad (your processed measurements) as a text file. *Save both so that you can go back to the raw data (Chart data) if you need to*. Open the data pad text file in Google sheets. Install Chart reader software onto your home computer for this purpose.

Saving Chart files for use on a PC (Windows 2000, XP)

You can work with your data in LabChart on your PC or Mac as long as you **save the file in Chart for Windows format**. To do this, in the "Save As" menu, select file format "Chart (win)" to save the file with the **.adicht** suffix.

Install LabChart reader on your home computer (the reader version) from the ADI website: https://www.adinstruments.com/products/labchart/versions-and-licenses