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.
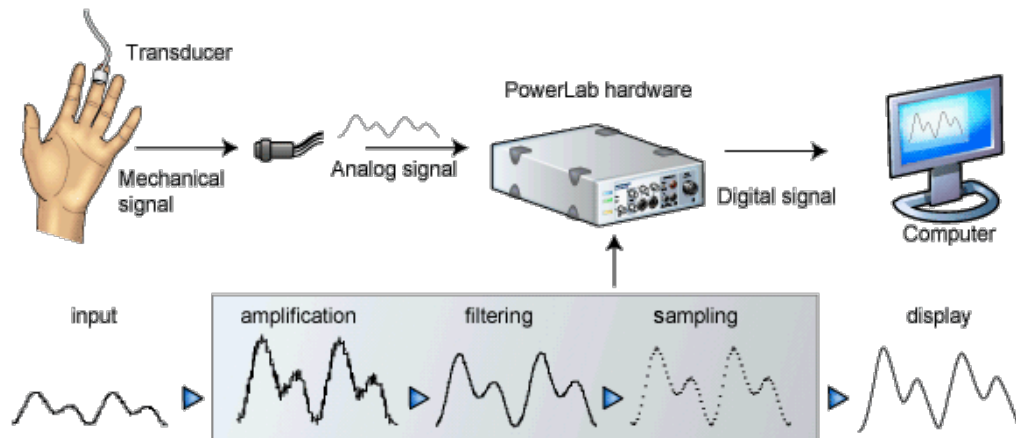

Figure 1. A summary of data acquisition using a PowerLab system.

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.
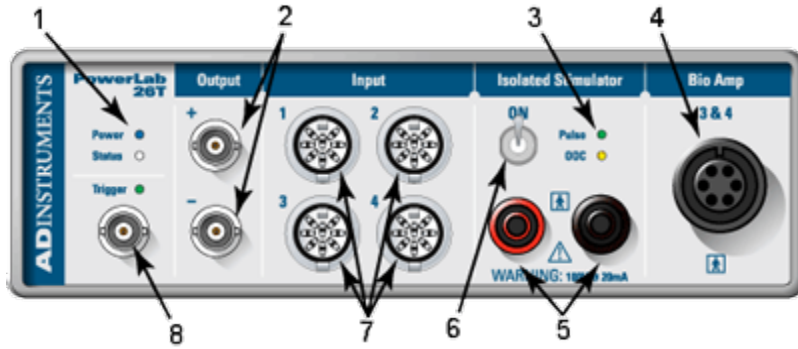
1. Power indicator light: illuminates when the PowerLab is turned on
2. Analog output connections: provide a voltage output in the 10 V range
    ⚠️This is NOT safe for direct connection to humans
3. Isolated Stimulator status light: indicates if the Isolated Stimulator is working properly (green) or 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
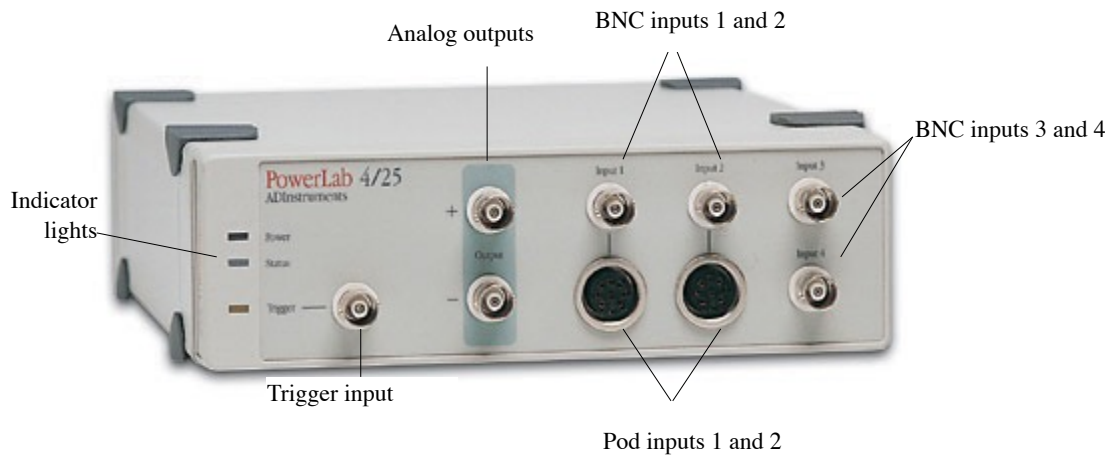

Figure 2. The front panel of the PowerLab 26T (top) and 4/25 (bottom). The look a little different but serve the same functions. We have 2 versions of 4/25 - red letter or blue letter models.

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.