

Removing Noise From Data Using Chart filters

Working in labs with electrical interference can make obtaining quality recordings difficult at times. While finding and removing the source of such interference is preferred, it can be challenging and occasionally impossible. However, with a basic understanding of the filtering options within Chart 5, one can still obtain clean data.

The first step in dealing with noise is determining the frequencies that comprise the signal. One can obtain this information by doing a quick recording of data, including both the signal of interest as well as the unwanted noise. After completing the recording, select the newly acquired data follow these easy steps.

1. Go to Window on the Menu bar and select Spectrum.
2. Click on one of the channel buttons above the viewing area to view the channel that contains the data.
3. The Spectrum window will then display the strength of the various frequencies of the recorded signal. Based on the type of recording, one usually knows where to expect the majority of the signal.
4. Those other frequencies not associated with the signal of interest that should be removed will be seen as spikes over a narrow frequency range.
5. Move the cursor over the histograms and identify the noise frequency

Removing noise

There are two ways to set up filters.

1. The first method involves filters built into the hardware that are controlled through the software. These can be found in the Input Amplifier on the channel pull-up menu. (When front-end amplifiers are attached to the PowerLab, different amplifier menus will appear with varying filtering options. While those will not be discussed here, more information can be found in their respective user manuals.)
 - a. Low-Pass Filtering: These filters will remove frequencies higher than the set value, but allow lower values to pass. This should be used when dealing with high frequency noise.
 - b. Mains Filtering: This will remove the common 60 Hz mains frequency of noise caused by electricity in the laboratory.
 - c. AC Coupled (High Pass) Filtering: This feature will set up a high pass filter that removes low frequency and DC components. (The cut-off frequency is 0.1 – 0.5 Hz, depending on the PowerLab model.) This filter is useful for removing drifting baselines in a signal.
2. A second method is to use the Digital Filtering feature in Chart. Also located in the channel pull-up menu, this feature allows for filtering through software calculations, rather than through hardware filters. These typically have more flexibility, allowing one to specify particular frequencies. Along with the usual low pass, high pass and notch filters, the digital filters include narrow band-pass, band-pass, and band-stop filters.
 - a. Narrow Band-Pass Filters: Narrow band-pass filters are used to remove all signal frequencies except for a particular band (i.e. to record 8 – 12 Hz activity in EEG recordings). Frequencies either side of this band are not passed.
 - b. Band-Pass Filters: A band-pass filter may be used to pass a larger range of frequencies (i.e. 0 – 100 Hz EEG activity). Frequencies either side of this band are not passed.
 - c. Band-Stop Filters: A band-stop filter blocks a certain range of frequencies and allows frequencies either side of this range to be passed (i.e. You may wish to block Beta [β1: 16 – 32 Hz] activity from an EEG recording but record all other frequencies between 0 – 15 Hz and 33 – 100 Hz).
 - d. Cut-Off Frequency and Center Frequency For low-pass filters, the cut-off frequency is the frequency at which higher frequencies are blocked and lower frequencies are passed. For high-pass filters, the cut-off frequency is the frequency at which higher frequencies are passed and lower frequencies are blocked. Band-pass and band-stop filters have two cut-off frequencies (representing lower and upper limits).

Between the hardware and software filtering features one is usually able to remove the majority of the signal interference. Please remember to be conservative with filtering to ensure that signals of interest are not removed.