Interactive Electrocardiograph Display

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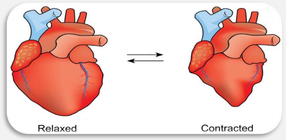
Q: What is an electrocardiogram (ECG)?

A: An ECG is a method used to measure and record the electrical activity of the heart. With every beat our heart contracts and relaxes producing electrical impulses monitored by the ECG.



Q: Why is an ECG important?

A: ECG can tell us the condition of the heart. ECG can also detect areas of the heart that may be deprived of oxygen or contain dead tissue.

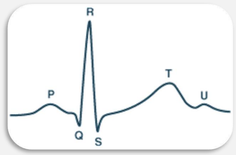
Q: How is ECG measured?

A: ECG is measured through electrodes that are placed on the human body at significant points to detect the electrical changes occurring when your heart beats.

Typical ECG Electrode

Q: What does the ECG look like?

A: ECG depicts your heart rhythm, and like the example shown in the diagram below.



Q: Does an ECG hurt?

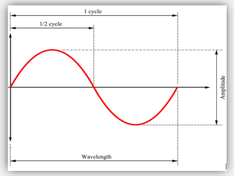
A: Not at all! The electrodes placed on your body are harmless and can be compared to a sticker. They simply stick on your skin and peel right off! You may sometimes see electrodes that clip onto the skin as well.

Q: What is the useful bandwidth of an ECG signal?

A: To understand the useful bandwidth of an ECG you should first understand what a wave represents. From this, you can gain an understanding of what frequency means and how frequency is measured.

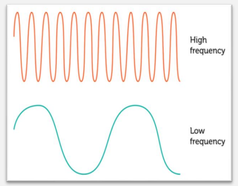
Q: What does a wave represent?

A: Examples of waves include sound, light, water and earthquakes. Each of these waves are signals summed up. Sine waves have a length called wavelength, a frequency which is the number of oscillations (or cycles) in a period of time and an amplitude (height).



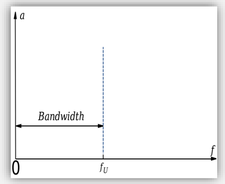
Q: What is frequency and how is it measured?

A: The frequency of a wave is the number of times per second the wave cycles and is measured in Hertz (Hz). Frequency is often represented by a lower case “f”.



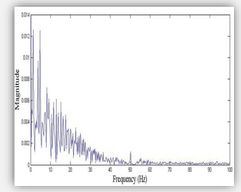
Q: What is the bandwidth of a signal?

A: For our purposes, the bandwidth of a signal is a range of frequencies that are used for transmitting a signal.



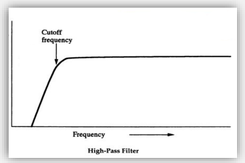
Q: So, what is the useful bandwidth of an ECG signal?

A: The useful bandwidth of an ECG signal ranges from 0.05 Hz to 100 Hz dependent on the application.



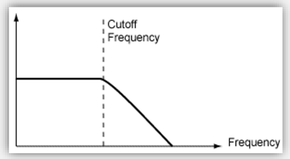
Q: What is a high-pass filter?

A: A high-pass filter passes signals with frequencies higher than the cut-off frequency and rejects signals with frequencies lower than the cut-off frequency. The cut-off frequency is a chosen value depicted by Fc.



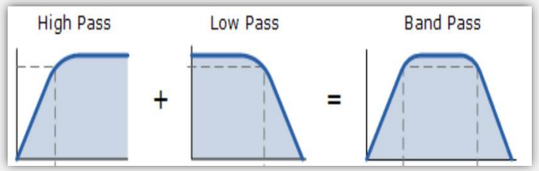
Q: What is a low-pass filter?

A: A low-pass filter passes signals with frequencies lower than the cut-off frequency and rejects signals with frequencies higher than the cut-off frequency.



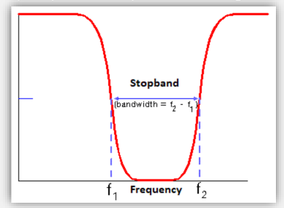
Q: What is a bandpass filter?

A: A bandpass filter is made by combining a low-pass and high-pass filter. Bandpass filters allow signals between two frequencies to pass, any signals outside of that range cannot pass.



Q: What is a Notch Filter?

A: A notch filter only allows frequencies outside of a certain range (known as the stopband) to pass. This passband range is small in size.

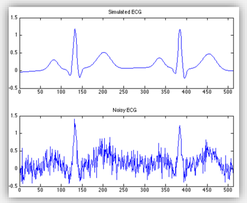


Q: What is an instrumentation amplifier?

A: An instrumentation amplifier allows amplifies the difference between the two inputs. Essentially, the amplitude of the signal being measured is increased. Increasing the amplitude helps to reduce the amount of noise effecting the signal. The amplifier also rejects additional noise effecting the signal from the inputs of the amplifier.

Q: What is noise?

A: Noise is unwanted disturbances that are captured when measuring and/or recording a signal. The first plot depicts a standard ECG while the bottom plot depicts a noisy ECG.



Q: What is an isolation amplifier?

A: The isolation amplifier can be found in the protection stage of our circuit. This amplifier limits the input range, rejects high frequencies and provides a barrier for high voltages. The isolation amplifier was added for precautionary measures to isolate the human body from the circuit.

Q: Why WPI?

A: WPI provides students with the ability to design their own path within their majors. At WPI students are immersed in a project-based curriculum where their work has an impact, and they gain hands-on experience within their major.

Q: Why study Electrical and Computer Engineering (ECE)?

A: WPI provides ECE students with the opportunity to learn more about a wide range of fields within ECE. Including, but not limited to: Machine Learning, Cryptography, Information Security, Signal Processing, Autonomous Vehicles, Prosthetic Controls and much more. In addition, ECE is now a growing field in the working world.