STETHOSCOPE BT80ST
FOR SOUND SENSOR BT80i

USER'S GUIDE

CENTRE FOR MICROCOMPUTER APPLICATIONS

http://www.cma-science.nl

Short description

The CMA Stethoscope BT80st can be used together with the CMA Sound sensor BT80i[1]. It uses a sensitive electret microphone in a standard stethoscope chest piece to allow the sounds to be converted into an electrical signal.

A stethoscope is designed to amplify the sounds created by the heart. A stethoscope consists of a membrane connected to an extension. The membrane is mounted under tension and is used to conduct the sound vibrations. When the membrane is held to a surface such as the skin, the membrane vibrates according with the surface. In this way the membrane conducts sound waves to the inner part of the stethoscope and to amplifier.

Measuring heart sounds

The stethoscope can be used to measure heart sounds. The sound of the hart is not directly produced by the contraction of the heart chambers. The sound is produced by the closing of the heart valves.

The heart makes a so-called 'lub-dub' sound. The first sound is produced by the closure of the mitral and tricuspid valves in early systole and is normally described as a "lub". It is a high-frequency sound and is loudest near the apex of the heart (point of heart, the furthest away from the veins and arteries).

The second heart sound is the sound of the closing of the pulmonary valve and the aortic valve during ventricular diastole and is described as a "dub". In this second sound two separate sounds of both valves can be heard. This sound is the loudest at the base (top of the heart as it lies in the living body).

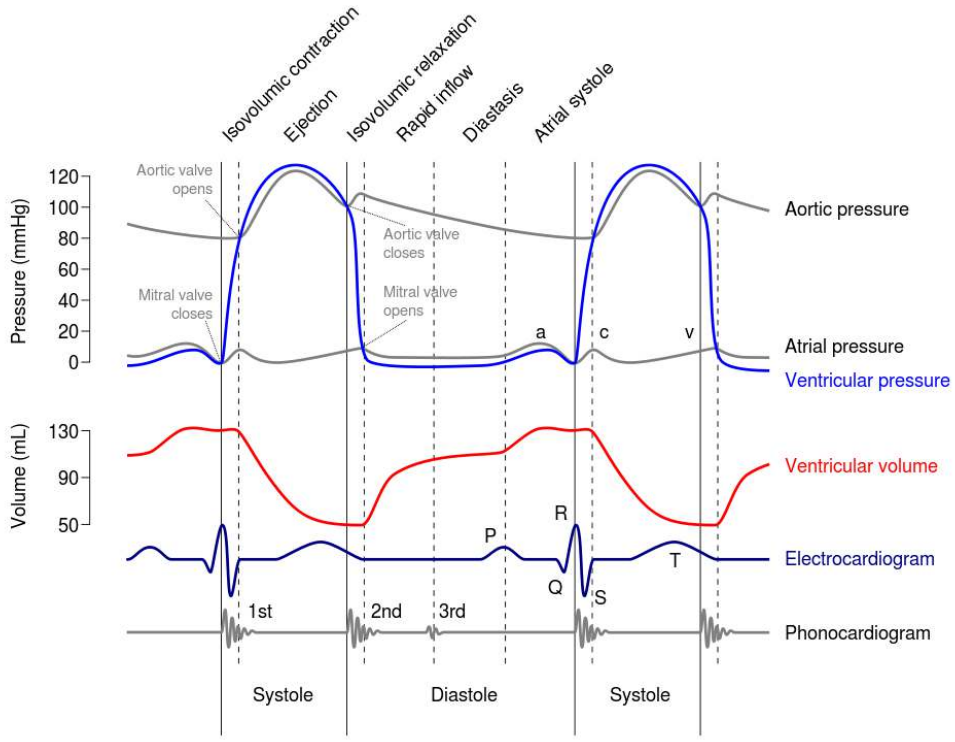

Figure 1. A Wiggers diagram, showing the cardiac cycle events (source: Wikimedia)

[1] The Stethoscope BT80st can be connected only to a new model of Sound sensor, sold starting from September 2019.

Proper placement of the bell of the stethoscope facilitates correct measurement. At each of the four locations on the chest (as shown on the image below), a different valve can be heard and a different pattern can be recorded.

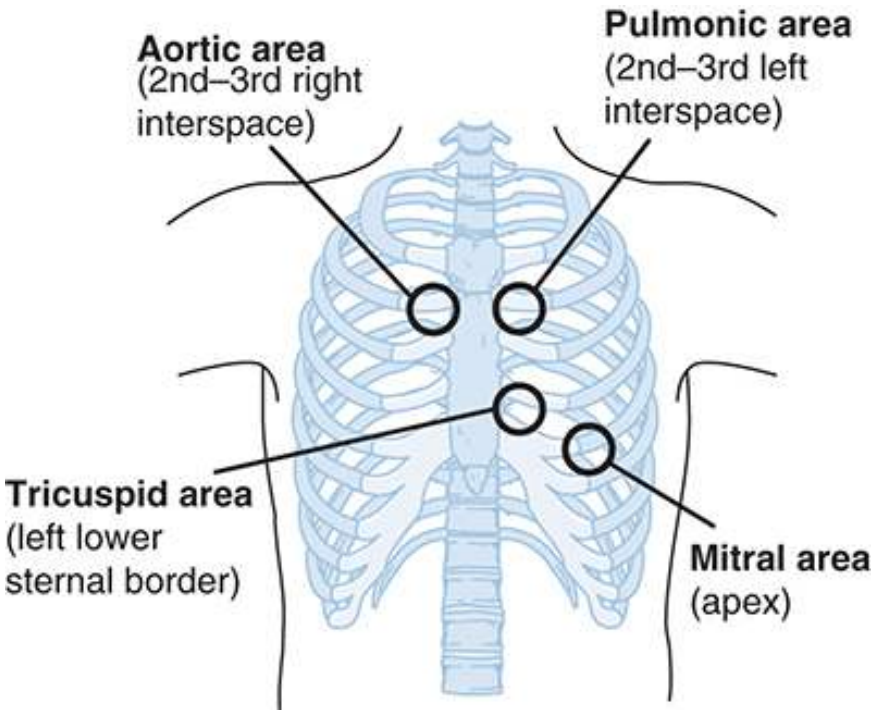

Figure 2. Standard positions of stethoscope placement for cardiac auscultation (https://wrhhs.org/chapter-2-the-cardiac-cycle-mechanisms-of-heart-sounds-and-murmurs/

Note the intensity of the heart sound will be effected by the sensors precise location. A relocation of even a few millimeters can change the intensity of sound and resulting pattern. Try moving the sensor a fraction and record several data collections to locate the optimal position. The points indicated are standard locations and may vary for different subjects.

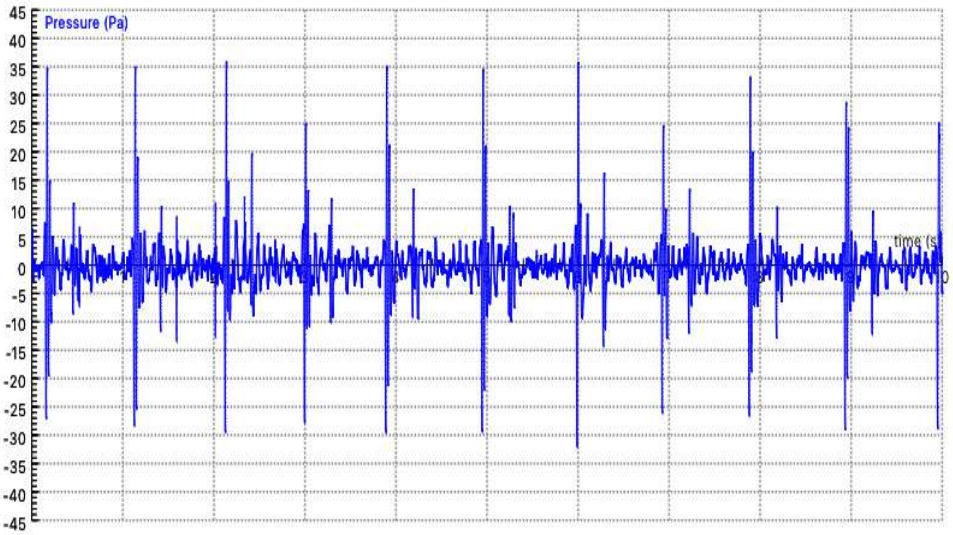

Figure 3. Example of data, measurement time, sampling frequency 2000 Hz,

Measuring speed of sound

The Stethoscope uses a very sensitive microphone and because of its shape is more effective in isolating the sounds being recorded. For example it is suitable for measurements of sounds in solids; the stethoscope can be placed directly onto the solid surface.

By using two sound sensors with stethoscopes speed of sound in gases or in solids can be determined. In such experiments a sound is detected by two Sound sensors, which are separated by a known distance. The time interval between the sound striking the first sensor and striking the second sensor is measured. The results are used to calculate the speed of sound.

Suggested experiments

The Sound sensor with the Stethoscope can be used to:

- Record heartbeats,
- Determine the heart rate,
- Together with a Blood Pressure sensor record the circulatory sounds,
- Together with an ECG sensor and/or a Heart rate sensor different measurements of the heart can be compared to analyse the entire heart cycle and the blood flow (see figure 1),
- Record sounds in solids,
- Determine the speed of sound in different gases or solids.

Warranty:

The Stethoscope BT80st is warranted to be free from defects in materials and workmanship for a period of 24 months from the date of purchase provided that it has been used under normal laboratory conditions. This warranty does not apply if the sensor has been damaged by accident or misuse.

Note: *This product is to be used for educational purposes only. It is not appropriate for industrial, medical, research, or commercial applications.*

Rev. 18/09/2019