

Signal Acquisition Module

This module consists of the diaphragm, conical shape, microphone and amplifier of the device. The main power of tracheal sounds lies between 100 and 1200 Hz^{50,51}. Thus, a microphone with a flat frequency response in that range is required to obtain the best signal. Depending on the chosen microphone and its transduction capabilities, an amplifier may be needed to provide an appropriate input voltage to the analog-to-digital converter. The chosen design outlined in this paper utilizes an electret microphone with built-in amplifier. As shown by the specifications sheets in the appendix, the *Adafruit Electret Microphone Amplifier-MAX4466 with Adjustable Gain* satisfies the criteria of the signal acquisition module. It features a flat frequency response between 50 and 2,000 Hz and also comes with an adjustable gain amplifier that can be tuned to optimize the signal.

The second component of the signal acquisition module consists of a diaphragm and acoustic chamber designed to transmit tracheal sounds to the microphone. For the diaphragm, a material with the appropriate properties to transduce acoustic signals from the suprasternal notch was necessary. Because of its utility in auscultating lung and tracheal sounds, a tunable stethoscope diaphragm was chosen—specifically, the *Littman: 36556 Tunable Diaphragm and Rim Assembly*. A tunable diaphragm is capable of picking up both high and low frequency audio signals therefore a tunable diaphragm is required to ensure the high frequency crackles, characteristic of individuals with pneumonia, are obtained. The conical section was not implemented as a separate device part, but rather as an in-folding of the device enclosure.