Tech Note

RM-204 Respiration Monitor

Overview

The RM-204 Respiration Monitor is a transducer used to measure the relative depth and frequency of breathing in a human subject during experiments where it is impractical to monitor breathing with a spirometer. For example, the use of a spirometer to monitor breathing during a psychological test could be a distraction that affects the results of the test. If the subject is not familiar or comfortable with breathing through a spirometer, the subject cannot focus on completing the test. The RM-204 permits breathing rates and relative amplitudes to be measured easily, accurately, and unobtrusively while the subject performs another task.

How It Works

The RM-204 Respiration Monitor has two components: a piezo-electric sensor that produces a voltage in response to movement; and an elastic belt that is placed around the chest to hold the sensor in place (Figure 1).

Figure 1: RM-204 Respiration Monitor

The primary motive force for pulmonary ventilation is the diaphragm, the large muscle between the thoracic and abdominal cavities. During inhalation, the diaphragm contracts, moves downward, and forces the abdominal wall to move outward. The process is reversed during exhalation. The piezo-electric sensor in the RM-204 detects the cyclic movement of the ventral body wall and generates a voltage that is proportional to the amount of movement.

Piezo-electric sensors are devices that generate a voltage in response to motion. When a piezo-electric sensor stops moving or is moving slowly, the voltage output of the sensor returns to its baseline level within milliseconds. To make this motion detector suitable for breath monitoring, the sensor of the RM-204 is fitted with a filter that slows the return of the voltage to its baseline level. Because of the filter, the RM-204 is able to record breath rates from 4 to 100 breaths per minute. However, when the subject is holding his or her breath, the voltage output of the sensor decreases very slowly. This decrease occurs because the filter cannot hold its voltage level indefinitely and still be a type that can respond to subtle changes in breathing.

Caution

Do not bend the sensor element in the cloth pouch! Bending will permanently damage the sensor.

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Figure 2: The RM-204 connected to Channel 4 of an IWX/214 data acquisition unit.

Equipment Setup

1. Plug the DIN connector of the RM-204 into the DIN input of an iWorx data acquisition unit or amplifier (Figure 2).
2. Wrap the elastic belt of the respiration monitor around the subject's chest at a level that is below the sternum.
3. Place the sensor inside the belt so that the sensor is in the center of chest at a level that is even with the subject's elbows. The cloth pouch should be placed inside the belt so the Velcro strip on the pouch is facing the inside of the belt.

Experiments

Experiments using the RM-204 Respiration Monitor can be downloaded by clicking on the following links:

Print-disabled Breathing Techniques and Variation in Heart Rate Experiment (PDF file)

User Area (password protected)
High Resolution Press Optimized Breathing Techniques and Variation in Heart Rate Experiment (PDF file).
Low resolution screen optimized Breathing Techniques and Variation in Heart Rate Experiment (PDF file).

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