

HEARTBEAT SENSOR

Description D037



Figure 1. The Heartbeat Sensor

Short description

The Heart Beat Sensor provides a simple way to study the heart's function. This sensor monitors the flow of blood through ear lobe. As the heart forces blood through the blood vessels in the ear lobe, the amount of blood in the ear changes with time. The sensor shines a light lobe (small incandescent lamp) through the ear and measures the light that is transmitted. The clip can also be used on a fingertip or on the web of skin between the thumb and index finger. The signal is amplified, inverted and filtered, in the box. By graphing this signal, the heart rate can be determined, and some details of the pumping action of the heart can be seen on the graph.

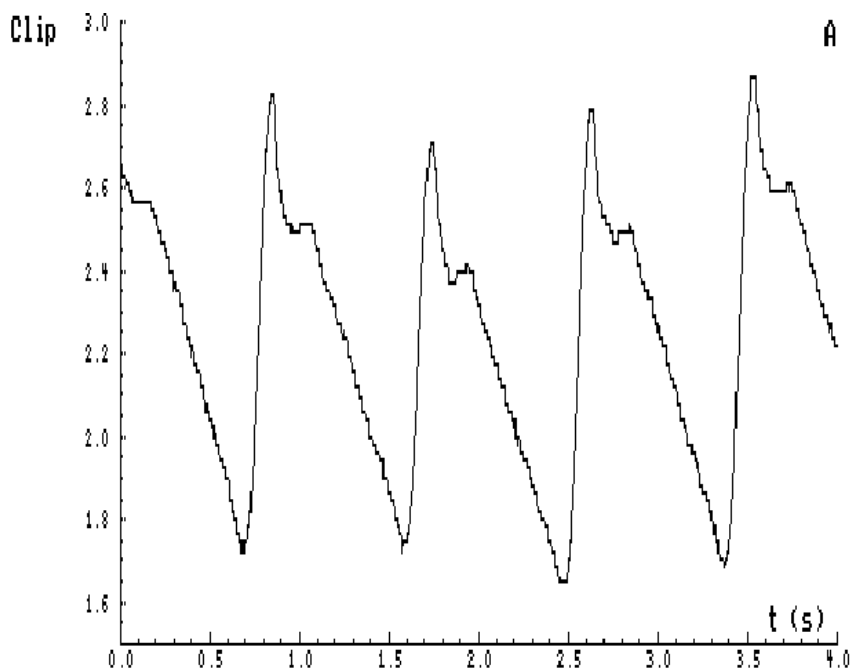


Figure 2. A sample measurement taken with the heartbeat sensor.

Figure 2 shows that the blood flowing through the earlobe rises at the start of the heartbeat. This is caused by the contraction of the ventricles forcing blood into the arteries. Soon after the first peak a second, smaller peak is observed. This is caused by the shutting of the heart valve, at the end of the active phase, which raises the pressure in the arteries and the earlobe.

The Heartbeat sensor is delivered with a BT-plug and can be connected to the following interfaces:

- UIA/UIB through Measuring console (via 0520 adapter)
- CoachLab
- CoachLab II
- SMI (via 0520 adapter)

- Texas Instruments CBL™ data-logger.

There is an adapter (art. 0520) to connect sensors with BT-plugs to 4-mm inputs.

Suggestion for experiments

- Measurements of the heart rate of different individuals.
- Measurements of the heart rate before and after exercises.
- Measurements of the recovery rate: how fast a person's heart returns to normal after exercises.
- Measurements of the heart rate before and after eating (drinking coffee or Coca-Cola).
- Simultaneous measurements of heartbeats, EKG and heart sounds with sound sensor to register heart tones.

Directions for use

In general you can use the heartbeat sensor as you would any other sensor connected to an interface. A waveform showing the heartbeat can be displayed and based on the time between the peaks the pulse rate can be determined. Often it is more convenient to use a program that simply displays the pulse rate in beats per minute. The control environment of Coach 5 software allows creating such a program.

- Connect the sensor to a channel of an interface.
- Place the ear-clip to the earlobe of the subject.
- Start a measurement.

The name of the heartbeat sensor in the sensor library of Coach 5 program is **Heartbeat sensor (037&bt) (CMA)**.

How fit are you

Heart rate varies between individuals. At rest, an adult man has an average pulse of 72 per minute. Athletes normally have a lower pulse rate than less active people. Children have a higher heart rate (approx. 90 beats per minute), but also show large variations. The heart rate rises during exercise and returns slowly to the rest frequency after exercise. The rate at which the pulse returns to normal can be used as an indication of fitness.

Improving the results


The sensor has reasonable immunity to disturbances, and so can also be used during exercise, for example on an exercise bicycle.

To obtain reliable results it is recommended that:

- You move the clip slightly if the signal is poor.

- The subject does not move their head greatly, and that the cable is clipped to their clothing.
- The ear and clip should be shaded from strong light.

Technical data

Amplification	x 200
Amplitude	Each heart beat gives one peak, which varies with the individual and is also dependent upon the positioning of the ear clip. However if the peak is less than 0.2 V the ear clip should be moved.
Box	Length = 10 cm; Width = 5 cm; Depth = 3 cm
Ear Clip	A lamp (slight warming of the ear is noticeable during a long experiment) and a light sensor.
Cable	Length 1.2 m, with a clip for attachment to the subjects clothing.
Connection	 BT (British Telecom) plug

Note: This product is to be used for educational purposes only. It is not appropriate for medical or research application. Specifically, it may not be used for patient diagnosis.

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