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Apr 2024

EKG Sensor

Product Number: ENEKG-A189

Overview

An electrocardiogram – abbreviated as EKG or ECG – is a test that measures the electrical activity of the heart. With each beat, an electrical impulse (or wave) travels through the heart. This wave causes the muscle to squeeze and pump blood through the body
The EKG (Electrocardiogram) sensor measures cardiac waveforms which illustrate how electrical impulses travel through along the heart. This provides users with a map of the heart.

The circuitry is designed to isolate users from electric shock. It is an ideal tool for experiments in Human Physiology.

The EKG (Electrocardiogram) sensor can be connected to the einstein™ Tablet, and einstein™Tablet+™, einstein™Labmate™, and einstein™Labmate+™.

Typical experiments

Human physiology

- Monitoring personal EKG
- Comparing EKG graphs at rest and after activity
- Investigating EKG with different body positions

How it works

Heart muscle cells are polarized at rest. This means the cells have slightly unequal concentrations of ions across their cell membranes. An excess of positive sodium ions on the outside of the membrane causes the outside of the membrane to have a positive charge relative to the inside of the membrane. The inside of the cell is at a potential of about 70 millivolts (mV) less than the outside of the cell membrane. The 70 mV difference is called the resting potential. The typical cell membrane is relatively impermeable to the entry of sodium. However, stimulation of a muscle cell causes an increase in its permeability to sodium. Sodium ions migrate into the cell through the opening of voltage-gated sodium channels. This causes a change (depolarization) in the electrical field around the cell. This change in cell potential from negative to positive and back is a voltage pulse called the action potential. In muscle cells, the action potential causes a muscle contraction. The sum action potential generated during the depolarization and repolarization of the cardiac muscle can be recorded by electrodes at the surface of the skin. A recording of the heart's electrical activity is icalled an electrocardiogram (EKG).

Sensor specification

Range:	0 – 5 V
Resolution (12-bit):	1.23 mV
Recommended Sample Rate:	100 samples/sec
Voltage Protection:	4 kV
Isoelectric Line (Gain):	1mV body potential = 1V sensor out put
Maintenance:	The electrodes should be kept refrigerated in a clean, dry, airtight container for storage

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

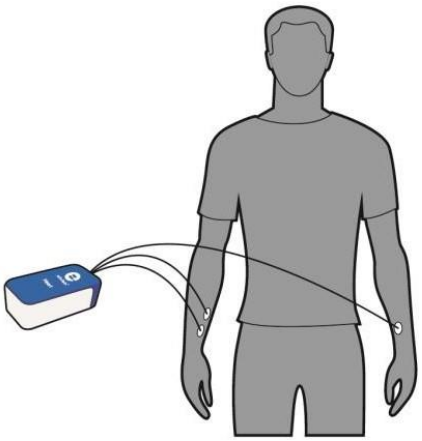
What's included

EKG sensor

100 Electrode patches

Connecting the EKG sensor to a person

- Use three electrode patches per subject. The electrodes can not be reused.
- Remove watches, jewelry, belts and rings.
- Because the electrical signal produced by the heart and detected at the body's surface is so small, it is very important that the electrode patch makes good contact with the skin.
- Clean the areas of skin where the patches will be attached with a paper towel to remove dead skin and oil.
- Peel three electrode patches from the backing paper. Firmly place the first electrode on the inside of the right wrist.
- Place a second electrode a few centimeters above the first one.
- Place a third electrode on the inside of the left wrist.
- Place each electrode so it is on the inside part of the arm (closer to the body) and the tab on the edge of the electrode patch is pointing down. This way, the wire of the sensor can hang freely without twisting the edge of the electrode patch.
- Connect the micro alligator clips of the three leads to the tabs on the edges of the electrode patches:
- Connect the two leads labeled R.A. (right arm) to the right arm electrode patches.
- Connect the lead labeled L.A. (left arm) to the left arm electrode patch



Technical notes

- The electrodes should be kept refrigerated in a clean, dry, airtight container for storage. Even with airtight storage, opened electrode packages cannot be stored from one year to the next.
- The presence of metal or magnets on the body can disturb the EKG signal.
- The sensor's circuitry isolates the user from the possibility of electrical shock in two ways:
- The sensor signal is transmitted through an opto-isolation circuit.
- Power for the sensor is transferred through a transformer. The circuitry protects against accidental over- voltages of up to 4,000 Volts.

Safety Instructions

This product is to be used for educational purposes only. It is not appropriate for medical or research applications. Specifically, it may not be used for patient diagnosis.
Always connect the ground lead (black) to the electrode before connecting the negative or positive lead.
If the insulation on a lead is broken do not use the sensor.
Never place an EKG sensor, patches, clips or leads near or in water or other liquids.
Do not put the positive lead on the right forearm or the negative lead on the left forearm.

Data logging, Calibrating and Analysis

The EKG sensor requires no calibration.

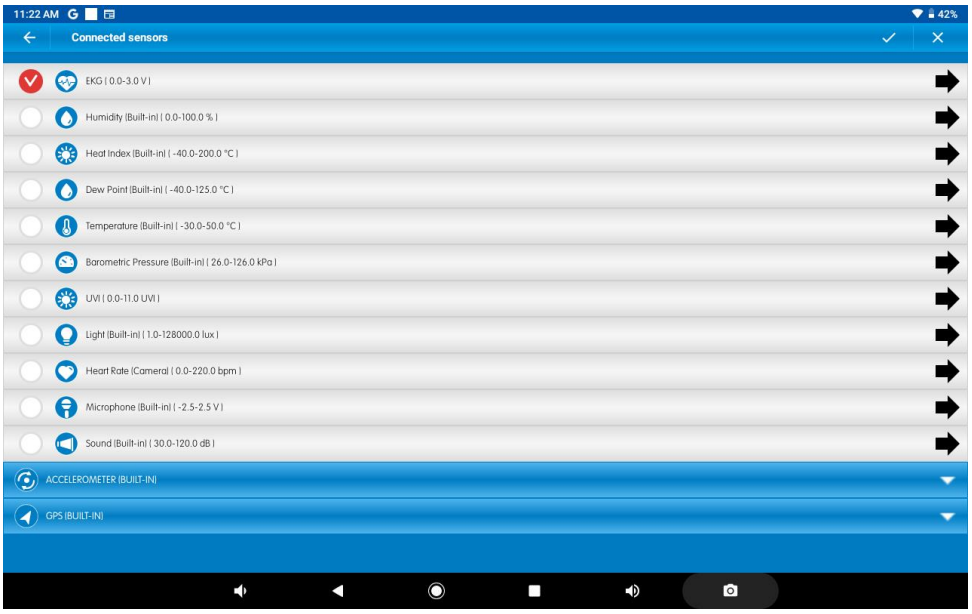
It is designed to produce a signal between 0 and 5 V, with 1 V being the isoelectric line.

MiLABEx™ Android & IOS

1. Take your einstein™ Tablet and open MiLABEx

Or open MiLABEx with your android/iOS device, go to LAB and "Connect a device" selecting your einstein™ LabMate™

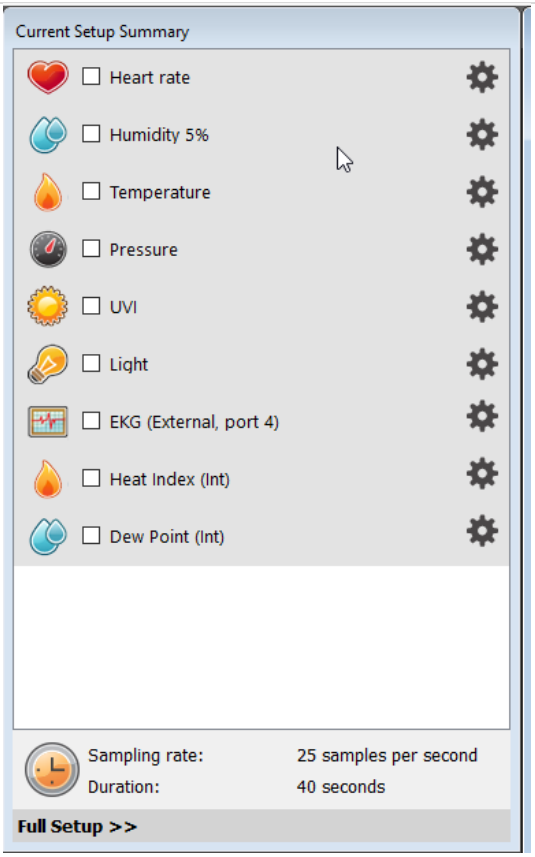
2. Make sure the icon is checked to enable it for logging



3. Tap on V to confirm selection and to go back to the Lab
4. Connect the electrodes to the patches
5. You are ready to experiment

Desktop MiLABEx

1. Connect your einstein™ LabMate™ to your PC with cable or pair it with Bluetooth
2. Connect the sensor to your LabMate – MiLABEx will detect it automatically.



3. Make sure to select the sensor
4. Connect the electrodes to the patches
5. You are ready to start an experiment

Troubleshooting

1. If the EKG signal is unclear with no recognizable pattern, check for the following:
   - 1.1. Electrode is off or defective
   - 1.2. Dirt on the skin interfering with the signal
   - 1.3. Metal object on the body interfering with the signal
   - 1.4. Twisted leads
   - 1.5. Loose electrode patches
2. If there is no signal display on the screen check for the following:
   - 2.1. The EKG sensor is not connected to the data logger
   - 2.2. Electrodes are loose
   - 2.3. Leads are misplaced
3. If the baseline drifts up and down:
   - 3.1. Make sure the subject's arms do not move and the leads are firmly in place.
4. If the R wave appears upside down:
   - 4.1. Make sure the leads are placed properly

Technical support

For technical support, you can contact the Fourier Education's technical support team at: Web: www.einsteinworld.com/support
Email: support@fourieredu.com

Copyright and Warranty

All standard Fourier Systems sensors carry a one (1) year warranty, which states that for a period of twelve months after the date of delivery to you, it will be substantially free from significant defects in materials and workmanship.
This warranty does not cover breakage of the product caused by misuse or abuse.
This warranty does not cover Fourier Systems consumables such as electrodes, batteries, EKG stickers, cuvettes and storage solutions or buffers.

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