Q-S207 EKG/EMG Sensor

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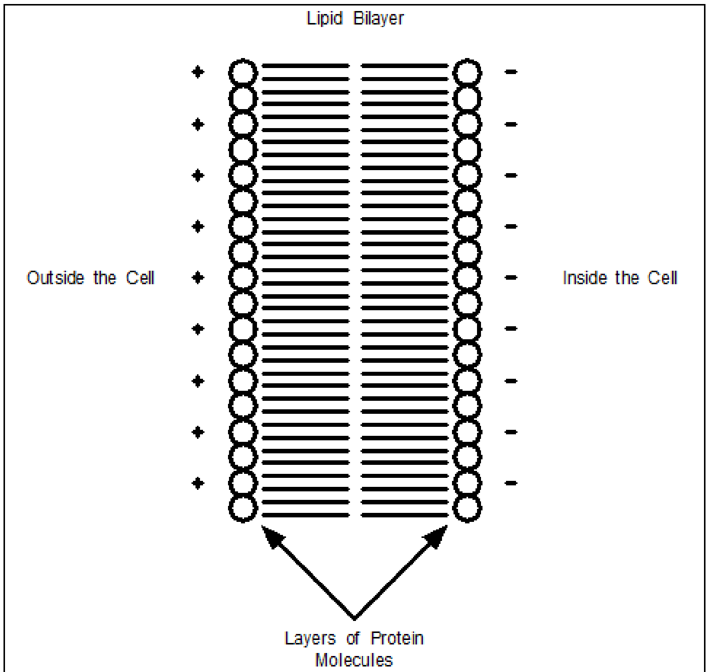
IMPORTANT NOTICE

The EKG/EMG Sensor described in this manual is for educational and research use only. It is not to be used as a clinical or diagnostic tool.

Overview of EKG/EMG

EKG (Electrocardiogram)

The Qubit EKG/EMG *(*Electrocardiogram/Electromyogram) Sensor measures voltage waveforms produced during the contraction of the heart (EKG) as well as during muscle contraction (EMG). The voltage changes are generated as follows.



Animal Cell Membrane (Section View)

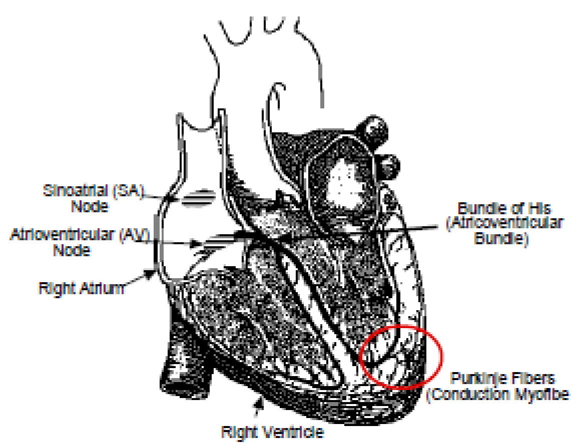
Heart muscle cells are polarized at rest, since the cells have unequal concentrations of ions across their cell membranes. An excess of positive sodium ions on the outside of the membrane causes the outside to be about 90 millivolts positive relative to the inside. This difference is the "resting potential". Cell membranes are impermeable to sodium, however, stimulation of a muscle cell causes a temporary increase in permeability to sodium. Sodium ions enter the cell through voltage-gated sodium channels. This change in cell potential from negative to positive (depolarization) and back (re-polarization) is called the "action potential", which causes a muscle contraction. Other ions and charged molecules such as potassium, calcium, chloride, and charged proteins are also involved in the action potential. The action potential can be recorded by electrodes at the surface of the skin. A recording of the heart's electrical activity is called an electrocardiogram (EKG) whereas recording of other muscles is called an electromyogram (EMG).

Spontaneous depolarization occurs in a cluster of cardiac-muscle cells in the upper wall of the right atrium. This group of cells is called the pacemaker or sinoatrial (SA) node. Depolarization of the pacemaker generates a current that depolarizes all other cardiac muscle cells. The wave of depolarization travels rapidly from the right to left atrium so both atria contract simultaneously.

The atria and the ventricles are isolated from each other electrically by connective tissue. Hence depolarization of the atria does not directly affect the ventricles. Another group of cells in the right atria, called the atrioventricular (AV) node, conducts the depolarization of the atria down a special bundle of conducting fibres (Bundle of His) to the ventricles. In the muscle wall of the ventricles, muscle fibres called Purkinje fibres bring depolarization to all parts of the ventricles simultaneously. This process causes a small time delay, so there is a short pause after the atria contract before the ventricles contract. Since the cells of the heart muscle are interconnected, this wave of depolarization, contraction, and re-polarization spreads across all of the connected muscle of the heart.

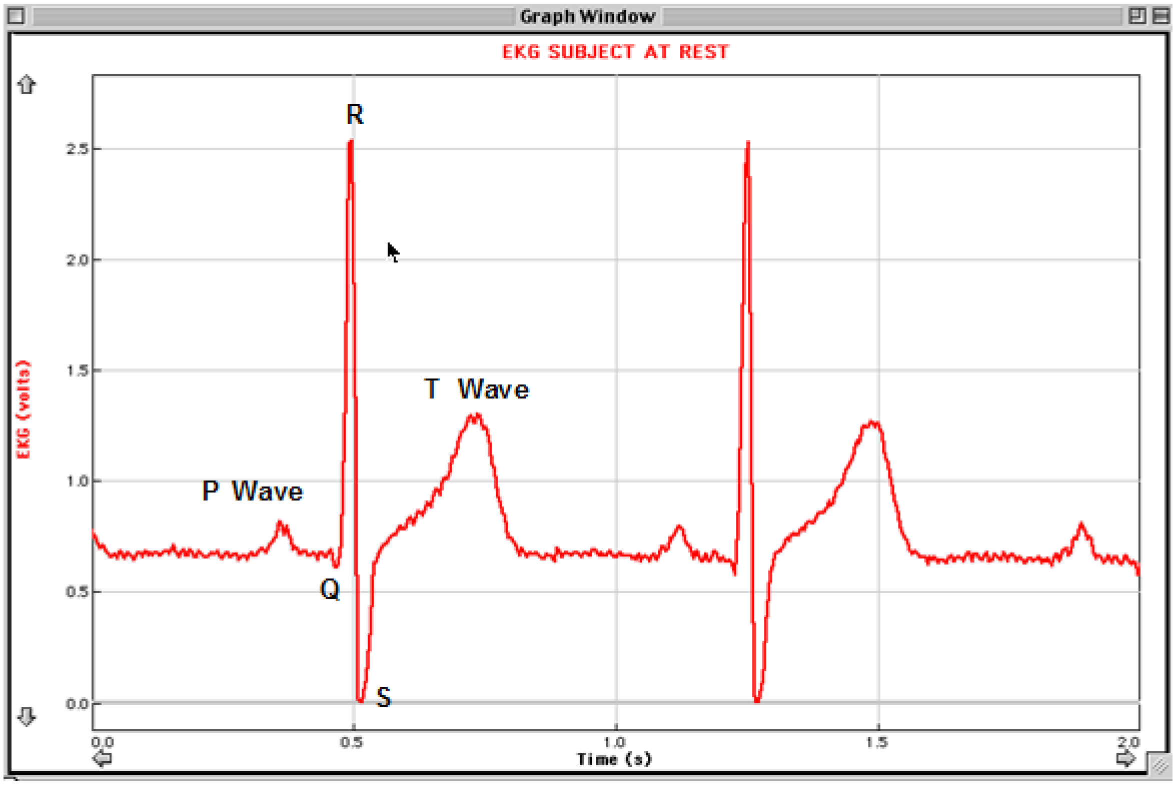
When a portion of the heart is polarized and the adjacent portion is depolarized, an electrical current is created that moves through the body. This current is greatest when one half of the connected portion of the heart is polarized and the adjacent half is not polarized. The current decreases when the ratio of polarized tissue to non-polarized tissue is less than one to one. The changes in these currents can be measured, amplified, and plotted over time. The EKG represents the summation of all the action potentials from the heart, as detected on the surface of the body.

The impulse originating at the SA node causes the atria to contract, forcing blood into the ventricles. Shortly after this contraction, the ventricles contract due to the signal conducted to them from the atria. The blood leaves the ventricles through the aorta and pulmonary artery. The polarity of the cardiac muscle cells returns to normal and the heart cycle starts again.



A typical electrocardiogram (EKG) is shown below. These repetitive waveforms arise from a flat baseline called the isoelectric line. Any deflection from the isoelectric line denotes electrical activity.

The Electrocardiogram



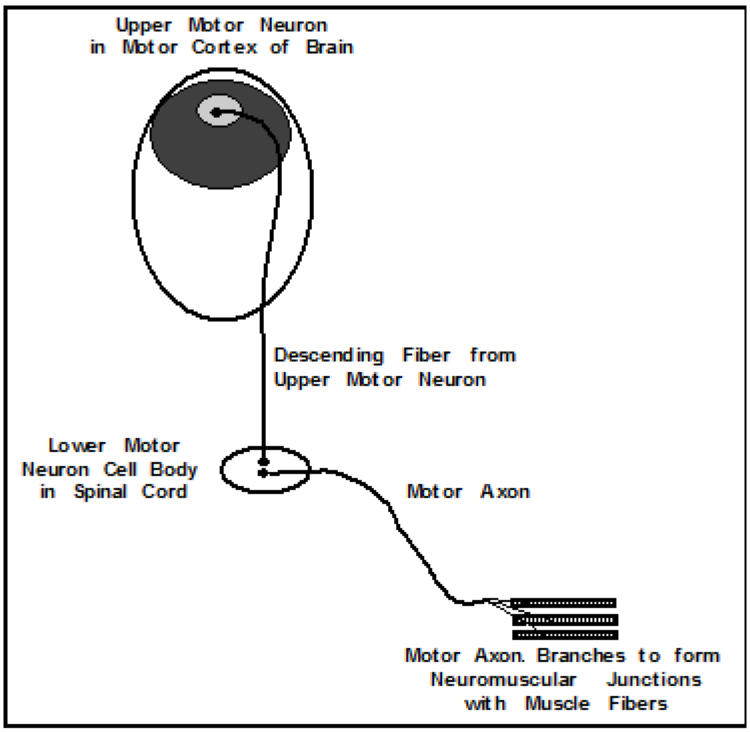
The 5 major deflections on a normal EKG cycle are designated by P, Q, R, S, and T. A cycle begins with the P wave, followed by the QRS wave complex, and ends with the T wave. The P wave represents depolarization (and contraction) of the atria. The QRS wave complex consists of three waves - Q (small negative wave), R (large positive wave) and S (negative wave). The QRS wave complex denotes depolarization and contraction of the ventricles. Atrial re-polarization occurs during depolarization of the ventricles. Therefore the waveform associated with atrial re-polarization is undetectable in an EKG. The last wave indicating ventricular re-polarization is the positive T wave.

The sequence from P wave to T wave represents one heart cycle. The number of cycles in a minute is the heart rate which is typically 70-80 beats per minute at rest. Some typical times for the EKG are:

P-R interval	0.12 to 0.20 seconds
QRS interval	less than 0.10 seconds
Q-T interval	less than 0.38 seconds

EMG (Electromyogram)

Muscle contraction is controlled by motor units that have both neural and muscular components. The neural component, called a motor neuron, has a cell body in the spinal cord and an axon that extends to a particular muscle. At the muscle the axon branches, hundreds or thousands of times, to connect with numerous muscle fibres at neuromuscular junctions. When the motor unit is activated (recruited), all the muscle fibres at which it has a neuromuscular junction are excited in synchrony. This produces an action potential, and a brief contractile response.



The excitation of the muscle fibres in a motor unit can be measured on the surface of the skin using electrodes attached to an Electromyograph (EMG). Each excitation causes a brief potential that appears as an electrical spike, called a motor unit spike. The pattern of responses from the muscle is called an electromyogram, in which the motor unit spikes are plotted against time.

Note that the EMG, like the EKG measures the *electrical* activity, not the *mechanical*, activity of the muscle. Associations between electrical and mechanical events can be studied by observing muscle movement while using the EMG sensor. This can be done visually by observing a knee jerk response after a patellar tap, or by using Hand Dynamometer together with the EMG Sensor.

Motor units differ with respect to the size of the motor neuron cell body and the diameter of the axon. Smaller motor units control a smaller number of fibres, whereas larger motor units in the same muscle control a larger number of fibres. The EMG can distinguish between motor units, because the smaller units produce an electrical signal of lower amplitude than the larger units. Thus, a large frequency of low amplitude motor unit spikes, indicates that many smaller motor units are operating.

The use of voluntary muscles is initiated by excitation of neurons in the motor cortex of the cerebrum. Upper motor neurons in the cerebrum have descending fibres that terminate in the spinal cord, where they can excite the cell body of the lower motor neuron. If a strong contraction of a muscle is required, a greater amount of excitation is produced in the descending fibres, which results in the stimulation of a greater number of lower motor units. The smaller motor units are activated first, and the number of these recruited, increases with the desired strength of the muscular contraction. For stronger contractions, the larger motor units are recruited, their number increasing as effort increases. For the greatest degree of effort, the very largest motor units are recruited. Thus, an electromyogram of a muscle that is put under increasing strain will show a series of low amplitude motor unit spikes to begin with, and then the frequency of these will increase before spikes of moderately high amplitude are recorded. When the muscle is contracted with the greatest effort there will be a high frequency of both low and moderate motor spikes with an increasing frequency of the highest amplitude spikes.

When the muscular effort is decreased gradually, the reverse situation occurs. The highest amplitude spikes disappear first, followed by the moderately high spikes, until at the lowest level of effort just a few of the lowest amplitude spikes remain.

Components for use with the EKG/EMG Sensor

Q-S207 EKG/EMG sensor
Power supply for Q-S207
A263 Tab Electrodes (pkg. of 100)
C610 LabQuest Mini data acquisition interface (not included)
C901 Logger Pro Data Acquisition Software (not included)
C404 Customized Setup Files (not included)
Manual

Quick Startup Steps

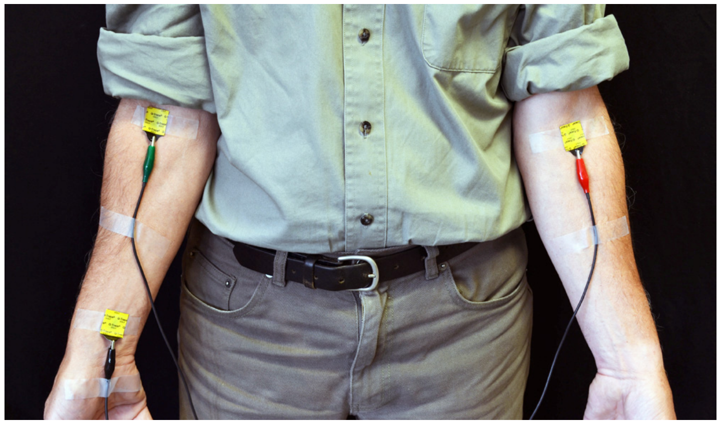
1. Load Logger Pro software onto the computer (see pg. 12)
2. Load C404 custom Qubit experimental files (see pg. 13)
3. Connect the power supply to the Q-S207 EKG/EMG
4. Connect the output data cable to (analog) channel 1 on the LabQuest Mini
5. Connect the USB cable between the LabQuest Mini and the computer

EKG Setup

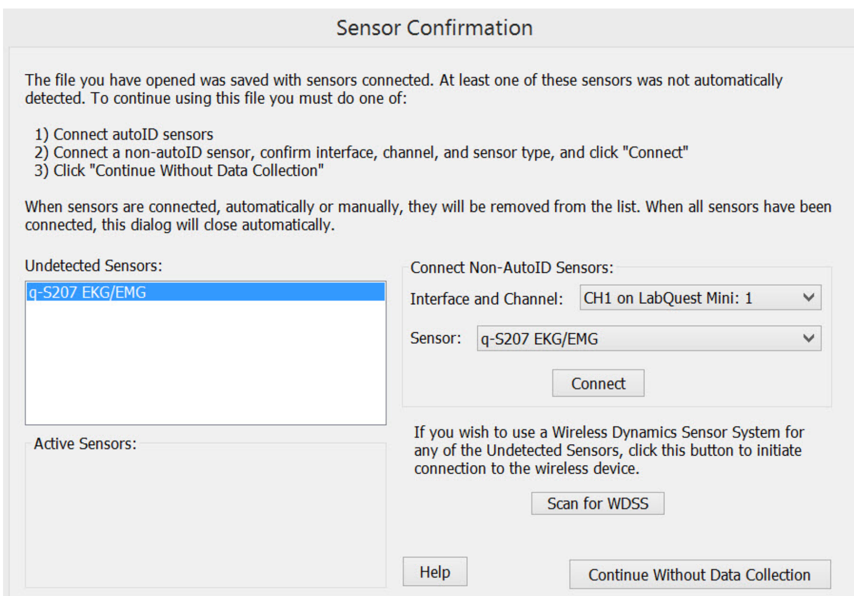
1. Place the switch on the Q-S207 in the EKG position (to the left)
2. **Connecting the Q-S207 to the Subject:**

Press the sticky tab electrodes onto the skin as shown in the photo below. Scrub the areas of skin where the patches will be attached with a paper towel to remove dead skin and oil. Rub the skin with a small amount of isopropyl (rubbing) alcohol to improve contact. Place each electrode so the tab points down.

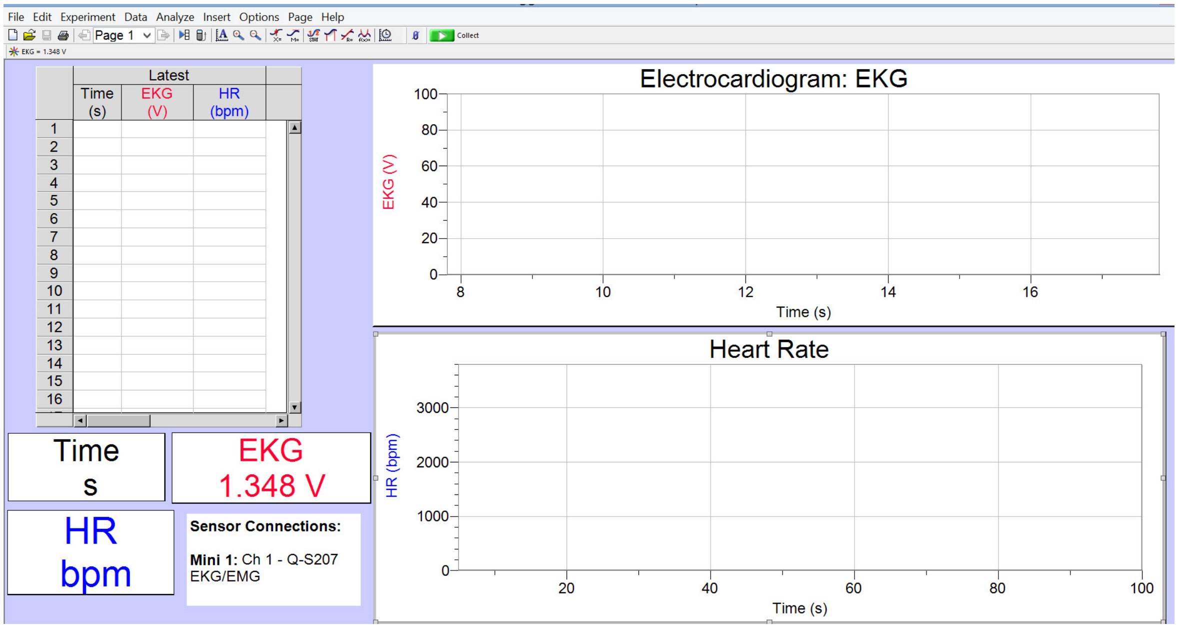
- Press the 1st electrode on the inside of the right wrist.
- Press the 2nd electrode on the inside of the right elbow.
- Press the 3rd electrode on the inside of the left elbow.
- Connect the black (or "reference") alligator clip to the right wrist electrode. This is the reference point for the isoelectric line (baseline).
- Connect the green (negative) alligator clip to the right elbow electrode.
- Connect the red (positive) alligator clip to the left elbow electrode.
  Note the wires may be taped to the arms to avoid pulling off the electrodes.
  Once opened, the electrodes should be stored in a refrigerated, clean, dry and airtight container.



3. Open the **Q-S207 EKG Setup** file to start the Logger Pro software. Note for convenience, a shortcut to this file can be placed on the desktop.
4. A Sensor confirmation screen will open in Logger Pro as shown below. "Connect" the Q-S207 EKG/EMG sensor on channel 1 of the LabQuest Mini.



Logger Pro will now open with the following screen setup for EKG. The page has a data table, signal meters and graphs. The user can easily customize the screen: new tables, meters or graphs can be added using the menu command Insert. Custom equations can be inserted with the menu command Data>New Calculated Column. Digital filtering can be accessed as a function in the new calculated equation. Histogram and FFT analysis is available for EKG signals via Insert>Additional Graph.



5. Let the subject relax. The output of the EKG/EMG sensor is now ready for an EKG experiment. See Appendix 1 for suggested EKG experiments.

It is important that the subject remains motionless during an experiment, since muscle movement will affect the signal.

Note: The Q-S207 outputs a 0-5 V voltage signal that does not require calibration by the user.

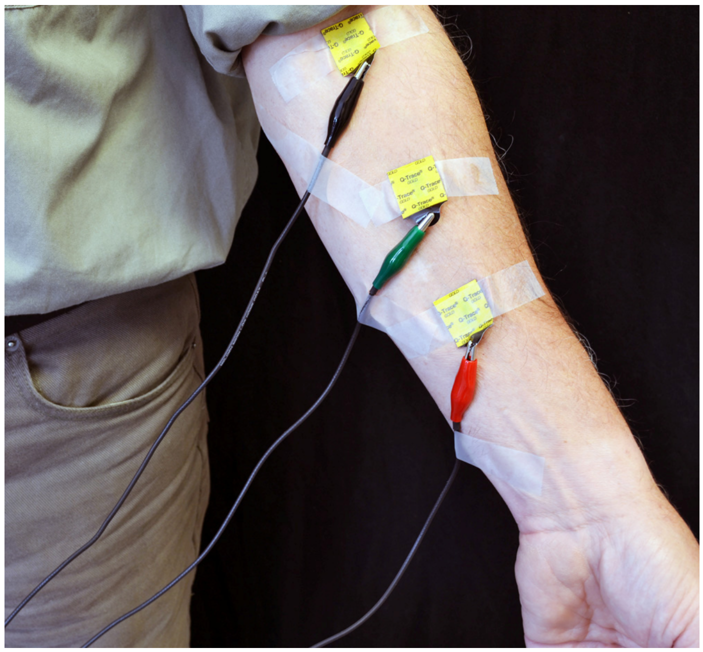
EMG Setup

1. Place the switch on the Q-S207 in the EMG position (to the right)
2. **Connecting the Q-S207 to the Subject:**

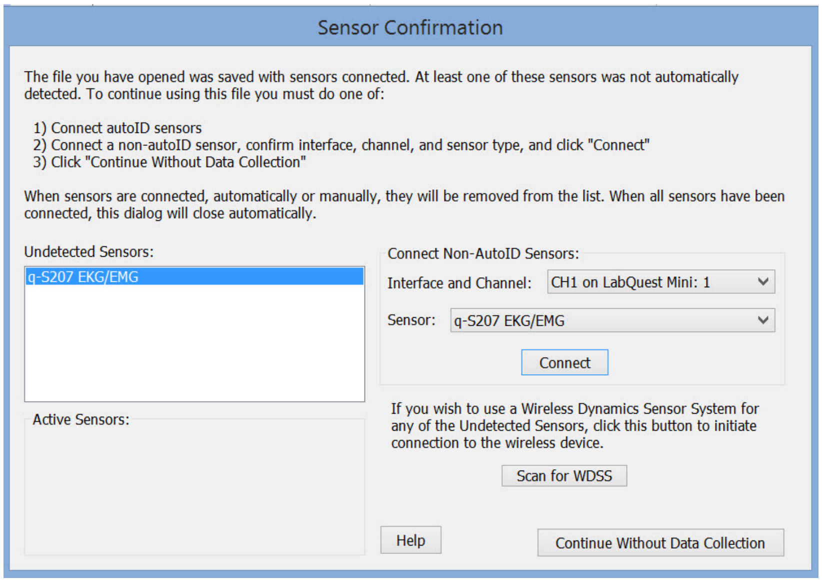
Press the sticky tab electrodes onto the skin as shown in the photo below. Scrub the areas of skin where the patches will be attached with a paper towel to remove dead skin and oil. Rub the skin with a small amount of isopropyl (rubbing) alcohol to improve contact. Place each electrode so the tab points down.

Two of the electrodes (positive-red; green-negative) are placed 5 to 6 cm apart on the skin overlying the muscle to be studied. The 3rd electrode (ground-black) is placed on the skin a short distance from the other two, outside the region where the muscle under study is active (e.g. on the ankle for calf muscle activity).

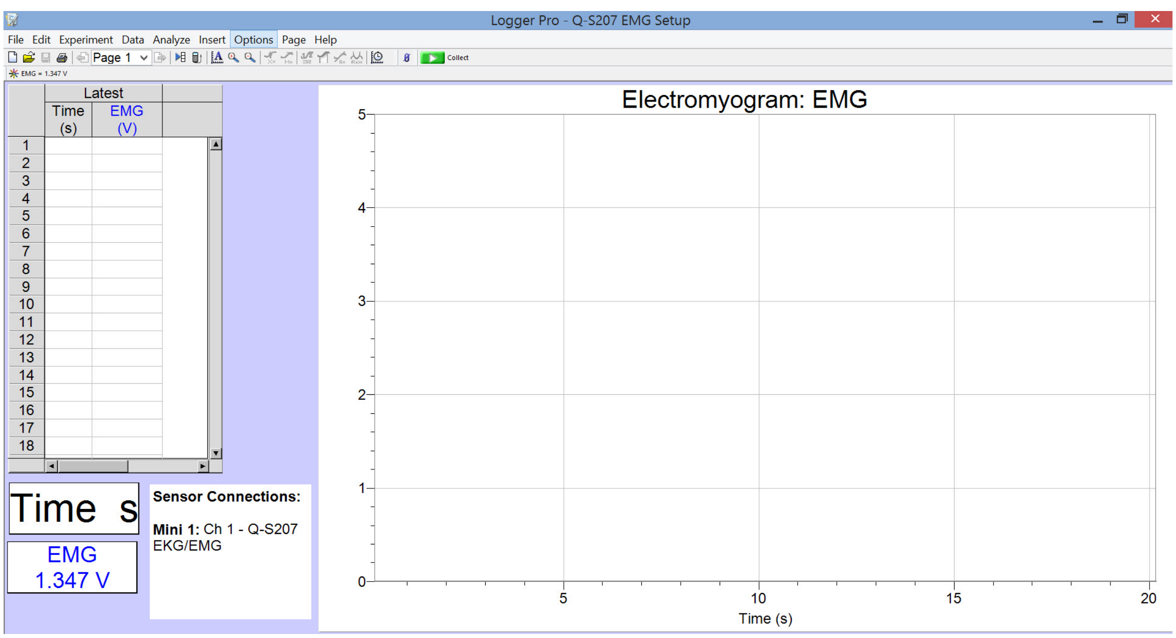
Note the wires may be taped to the arms to avoid pulling off the electrodes. Once opened, the electrodes should be stored in a refrigerated, clean, dry and airtight container.



1. Open the **Q-S207 EMG Setup** file to start the Logger Pro software. Note for convenience, a shortcut to this file can be placed on the desktop.
2. A Sensor confirmation screen will open in Logger Pro as shown below. "Connect" the Q-S207 EKG/EMG sensor on channel 1 of the LabQuest Mini.



Logger Pro will now open with the following screen setup for EKG. The page has a data table, signal meters and a graph. The user can easily customize the screen: new tables, meters or graphs can be added using the menu command Insert. Custom equations can be inserted with the menu command Data>New Calculated Column. Digital filtering can be accessed as a function in the new calculated equation. Histogram and FFT analysis is available for EMG signals via Insert>Additional Graph.



3. Let the subject relax. The output of the EKG/EMG sensor is now ready for an EMG experiment. See Appendix 1 for suggested EMG experiments.

It is important that the subject remains motionless during an experiment, since muscle movement will affect the signal.

Note: The Q-S207 outputs a 0-5 V voltage signal that does not require calibration by the user.

Data Acquisition Using the LabQuest Mini Interface

LabQuest Mini Interface

The LabQuest Mini interface has 3 analog and 2 digital channels. The interface is connected to the computer (PC or Macintosh) by a USB cable. The interface converts the analog voltages (12 bit A to D) to digital signals which are transmitted to the computer via USB and processed by the Logger Pro software. The green LED indicates that the LabQuest Mini is recognized by the drivers and ready to collect data.

Installing and Running Logger Pro 3

PC Users:

(1) To start, a complete copy of Logger Pro 3 must be installed on the computer. Before starting the installation, make sure all USB cables are disconnected from the computer. Failure to do so may cause an error in the installation of the drivers.

(2) Run the installation and do not change the default destination directory. Logger Pro 3 will be installed in C:/Program Files/Vernier Software/Logger Pro 3.

(3) The setup process will automatically load the USB drivers for connecting the LabQuest Mini or other interfaces to the computer.

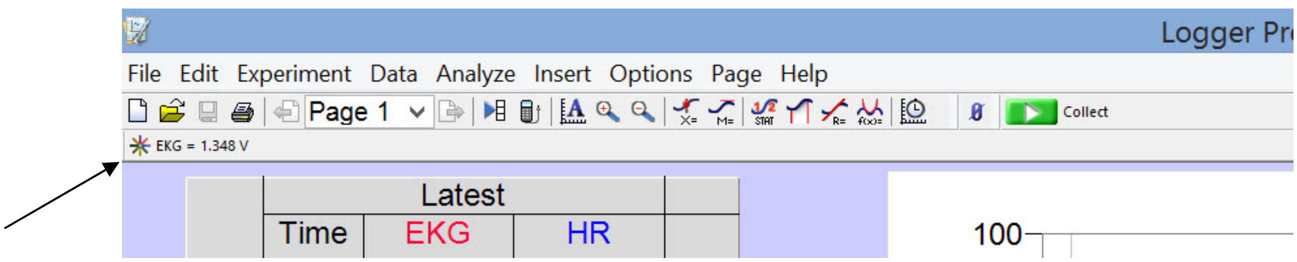
(4) If QuickTime 6 (or greater) is not installed on the computer, install it when prompted. QuickTime will allow use of the picture and movie features of Logger Pro 3.

(5) You will be prompted to connect the LabQuest Mini or other interfaces to the computer via the USB connection.

(6) Click 'Finish' to complete the installation process.

(7) Proceed to the C404 installation (below) before opening the Logger Pro with the "Q-S207 EKG Setup" or "Q-S207 EMG Setup" file.

(8) Double click the "Q-S207 EKG Setup" or "Q-S207 EMG Setup" file (create a shortcut on the desktop once moved from the C404 disk for easy access) to start Logger Pro and data collection. If Logger Pro detects the LabQuest Mini interface, the Logger Pro screen will appear with a star (icon for LabQuest Mini) in the top left corner.



(9) If Logger Pro cannot detect the LabQuest Mini Interface, a message will appear "no device connected". The LED on the Mini should be green. A red LED indicates that power is on (supplied by the computer through the USB) but there is no communication between the interfaces and the computer. In this case, exit the "Q-S207 EKG/EMG Setup" file and unplug the USB cable from the computer. Reconnect the USB cable. Allow the computer to recognize the Mini (bell tone) and then re-open the "Q-S207 EKG/EMG Setup" file.

Macintosh Users:

(1) **To start, a complete copy of Logger Pro 3 must be installed on the computer (You must be using at least OS 9.2). Run the "Complete Installation" and ensure all USB cables are disconnected. The following instructions are the same as those for PC users.**

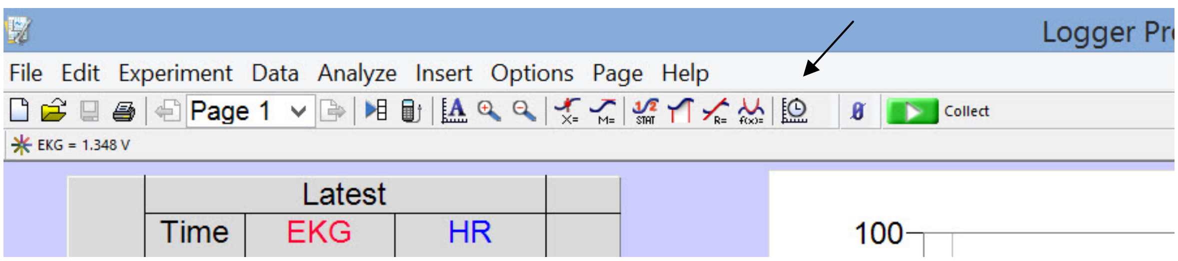
C404 Custom Setup Files:

Qubit Systems' C404 Custom Setup Files CD contains all of Qubit Experiment files (designed by Qubit Systems) including "Q-S207 EKG Setup" and "Q-S207 EMG Setup". The Experiment files contain the setup (i.e. graphs, table, calculations etc) for the various experiments, as well as the calibration constants for the Qubit sensors. The C404 disk also contains manuals for the different Qubit sensors and packages. These files can be copied to user specified location on the computer and the experimental file of interest for this sensor – “Q-S207 EKG Setup” and “Q-S207 EMG Setup” should be placed in an accessible location or have a shortcut created on the desktop to the file.

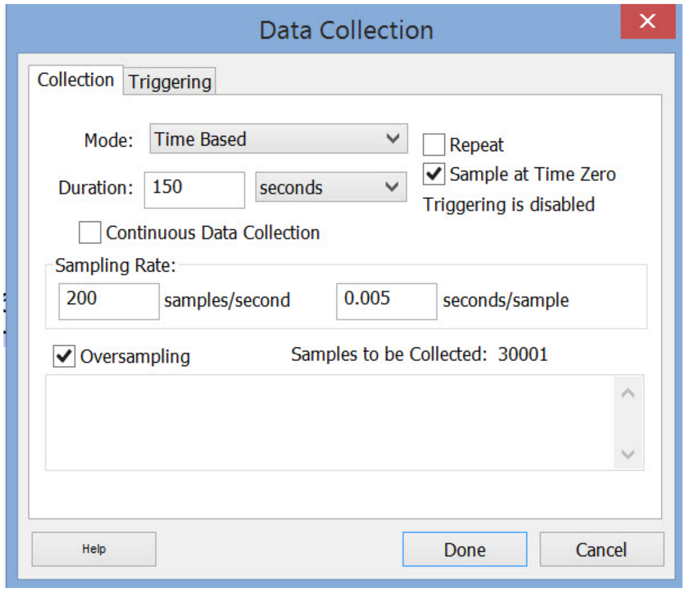
Graph Ranges, Run Time and Data Collection Rate

To modify the range of the x and y-axes, click on the maximum and/or minimum values and type in the new values.

If you wish to alter the maximum time allotted to your experiment or the rate of data sampling, select “Experiment”, then “Data Collection” or click on the clock icon in the top menu.



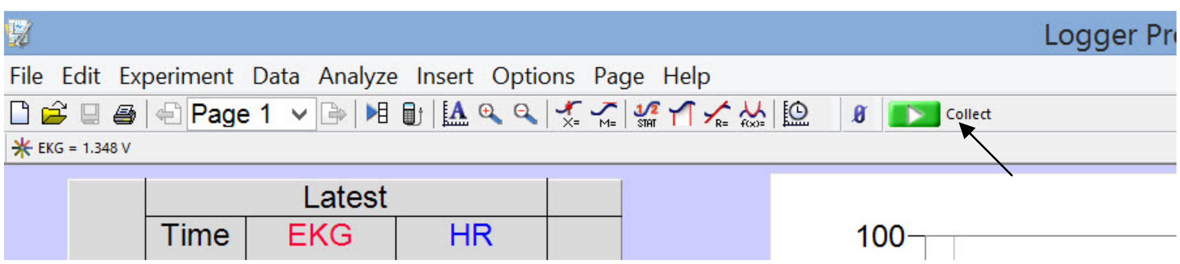
Type in the run time of your experiment in the box labelled “Duration”. **Note that the maximum value you select for the Time-axis limits the time over which you can collect data for a particular run.** If your experiment exceeds the allotted time, select “Experiment”, then “Store Latest Run”. You may then restart data collection. Data from the first part of your experiment will remain on the screen as a faint trace and new data will be plotted in a bolded shade of the same colour. You can collect numerous runs in this way. Each run will be collected to a separate data table. When you save your data, all of the runs will be saved under the same file name.



You may also alter the "Sampling Rate" at which you collect data. The default rates for EKG and EMG are 500 and 1000 samples/s, respectively.

Data Collection and File Saving

To start data collection, click on the “Collect” green icon above the graphs. This will change to a “Stop” red icon. Click on the “Stop” icon to stop data collection.



Data Analysis with Logger Pro 3

(1) Position the cursor at the beginning of the data set that you wish to analyze, then click and hold with the mouse.

(2) Drag the cursor across the data set and unclick. A greyed box will appear on the screen to show the data range to be analyzed.

(3) Select “Analyze”, and then choose from a wide variety of analysis options. For example, use:

- “Examine” to scroll through the data points at specific time intervals.
- “Integral” to integrate the selected data.
- “Statistics” to automatically perform a variety of statistical analyses.

You can also fit curves and tangents to the selected data by choosing the appropriate menu option. Note the analysis functions can also be accessed from icons in the menu.

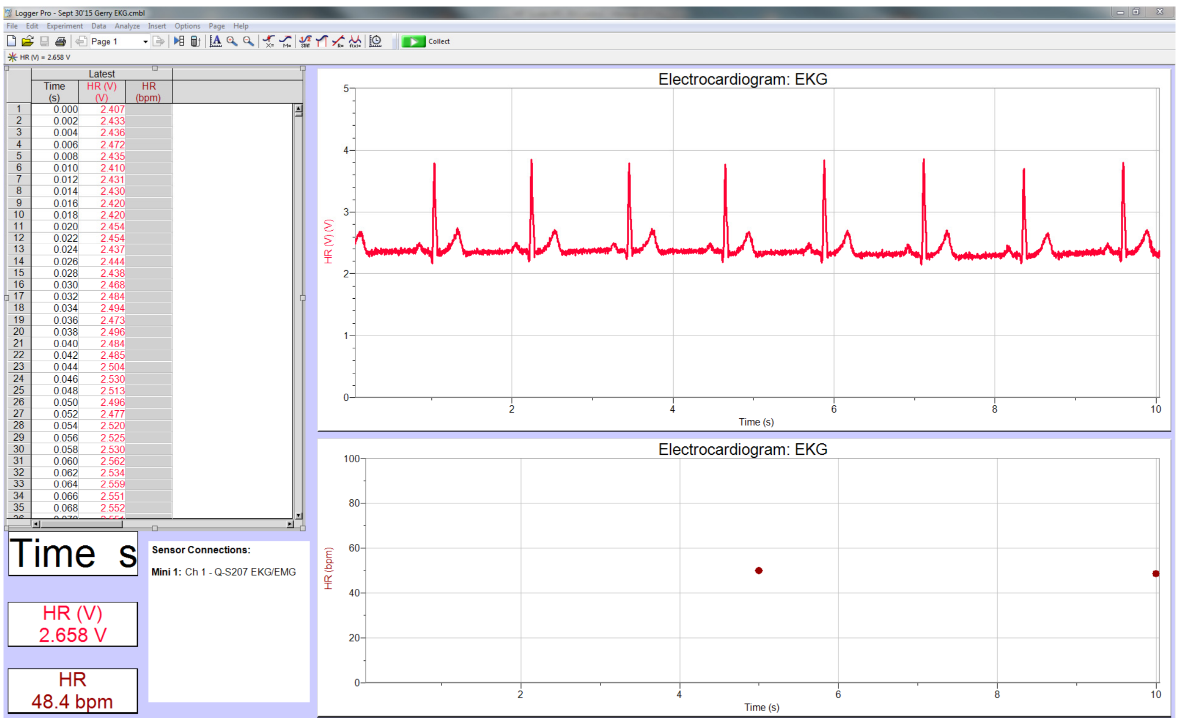
EKG/EMG Specifications

- power supply: 9V DC, 560mA
- units: Volts
- resolution: 0.0012 Volts
- accuracy: 1% Full Scale, or better
- offset: N/A
- gain: 1076
- Cut-off Frequency fc: Low Pass = 1.6kHz, fc High Pass = 0.2Hz
- size (h/w/l) cm: 2.8/6.2/9.2
- weight (g): 210
- materials: plastic (black)
- subject isolation: 1500 V rms
- warranty: 1 year

Appendix 1: Suggested EKG Experiments with the Q-S207 Sensor

(1) Resting EKG

Record the EKG of a subject at rest. The person should remain relaxed and breathe normally. The following screen shot shows a resting EKG recorded in Logger Pro. The heart rate is calculated every 5 sec using the large "R" peaks.



Using the displayed graph in Logger Pro, record the following information:

Interval Analysis	
Interval	**Time (milliseconds)**
P-Q	
QRS	
Q-T	

Heart Rate Analysis	
Item	**Rate (per minute)**
Minimum	
Maximum	
Average	

In a teaching lab these data may be distributed to the class for further statistical analysis.

(2) EKG After Mild Exercise

Record an EKG of a person who is initially at rest. Disconnect the sensor wires from the electrodes, but leave the patches on the subject. Have the person exercise for 3 minutes by jogging "on the spot". Reattach the sensor wires to the electrodes when the subject has finished exercising and record a new EKG. Compare the resting EKG to the EKG after mild exercise.

(3) EKG and Different Body Positions

Record the resting EKG in a sitting position. Then have the person stand or lie down and record a second EKG. Compare the new EKG with the resting EKG in a sitting position. Note any changes in heart rate, interval times, height of R wave, etc.

(4) EKG and Mild Stimulants

Have the subject drink a couple of cups of caffeinated coffee or cola. Record an EKG. Compare the results with those at rest and following mild exercise. Note: This might show less effect on people who are accustomed to large amounts of caffeine.

(5) EKG and Electrode Position: Axis of the Heart

Note: This is a more advance exercise.

Different arrangements of electrode patches will change the shape and intensity of the measured signal. Each arrangement is called a "lead." Each lead reveals unique information based on the lead's orientation relative to the axis of the heart. Remember to scrub the areas of the skin where the electrode patches are placed with a paper towel to remove skin oil and moisture.

Lead I:

- Put an electrode on the right upper arm. Connect the green (negative) alligator clip to this electrode.

- Put an electrode on the left upper arm. Connect the red (positive) alligator clip to this electrode.

- Put an electrode on the inside surface behind the right anklebone. Connect the black (or "reference") alligator clip to this electrode. This is the reference point for the isoelectric line.

- An imaginary line between the red and green electrodes shows that this lead is measuring polarity changes across the chest, above the heart, and parallel to the shoulders.

Lead II:

- Put an electrode on the right upper arm. Connect the green (negative) alligator clip to this electrode.

- Put an electrode on the inner surface of the left thigh. Connect the red (positive) alligator clip to this electrode. Note: Instead of the left thigh, you can use the inner surface of the left ankle just behind the left anklebone.

- Put an electrode on the inside surface of the area behind the right anklebone. Connect the black (reference) alligator clip to this electrode.

- An imaginary line between the red and green electrodes yields an oblique line from the right shoulder towards the left leg. **Lead II generally gives the greatest variation of impulse** and is the EKG usually shown in movies, textbooks, etc.

Lead III:

- The lead III arrangement has the green (negative) electrode connected to the left arm and the red (positive) electrode connected to the left inner thigh with the black (reference) electrode connected to the inside of the right ankle as before. Note: Instead of the left thigh, you can use the inner surface of the left ankle just behind the left anklebone.

- This arrangement of the red and green electrodes yields an imaginary line from the left shoulder to the left leg.

- If the three imaginary lines were connected, they would make a triangle. This triangle is called the Einthoven triangle. The measured intensity of voltage on its three sides can be used to study heart functions and anatomy. You can make an approximation of the axis of your heart: that is, the orientation of the centreline of the mass of your heart.

- Record a Lead I EKG, a Lead II EKG and a Lead III EKG. Compare the results. Determine which lead yields the maximum R-wave amplitude.

- If the maximum R wave is with Lead I, then the axis of your heart is approximately at O degrees as measured from the horizontal and your left.

- If the maximum R wave is with Lead II, then the axis of the heart is approximately 60 degrees down from the horizontal and to the left.

- If the maximum R wave is with Lead III, then the axis is approximately 120 degrees from the horizontal and your left.

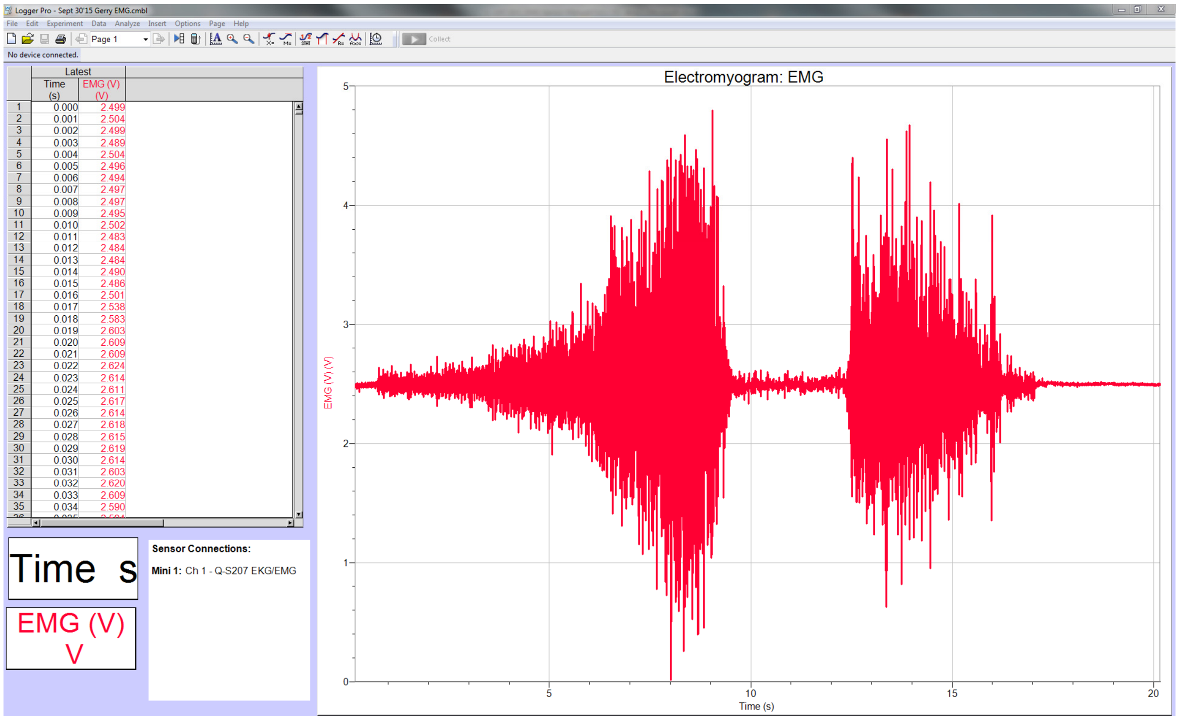
- You can make a further refinement in your estimate by noting the relative proportion of R wave strength between the two leads with the largest R wave.

- If the Lead II and the Lead III R waves are about equal, then the axis is about halfway between the 60-degree angle and the 120-degree angle. You could therefore estimate the axis of the heart to be nearly vertical.

  Note: The heart's axis varies with general body shape. Very slender and elongated people tend to have a more vertical heart. Short and stocky people tend to have a more horizontal axis.

APPENDIX 2: SUGGESTED EMG EXPERIMENTS WITH THE Q-S207 SENSOR

The following screen shot shows an EMG from a forearm muscle recorded by the Q-S207 with Logger Pro. Increasing tension was applied in the first muscle contraction.



The EMG Sensor may be used for various studies of the electrical activity of muscles.

(1) Involvement of specific muscles in specific actions: Attach the electrodes to the skin over the gastrocnemius (calf) muscle. Determine to what extent this muscle is involved in:

(i) Flexion of the foot upward and downward when the subject is sitting without weight being placed on the leg.

(ii) Raising the foot onto the toes, and then rocking the foot back onto the heels when the subject is standing.

(iii) Control of balance. This is best done while the subject is standing on one leg, with the electrodes attached to the gastrocnemius muscle of that leg. The tips of the index fingers may be rested lightly on the bench-top to assist balance. It is interesting to observe changes in the muscle activity when the eyes are open and closed. Is the muscle "quieter" when the eyes are open? To what extent is the excitation of the muscle under voluntary control?

(2) Investigations of reflex responses to a tendon tap: Attach the electrodes to the skin over the gastrocnemius muscle while the subject is sitting with feet off the floor and the leg relaxed. Tap the patellar tendon to elicit a knee jerk and observe the EMG signal. Tap the Achilles tendon and observe the response. Which, if either, of these treatments elicits a response? Is the magnitude of the EMG signal related to strength of the tap on the tendon?

(3) Comparison of fatigue between similar muscles on the right and left side of the body:

- For a given force exerted repeatedly, how does motor unit recruitment differ between the left and right sides?

- How does motor unit recruitment change as the force is increased? Does this differ between left and right sides?

- How does motor unit recruitment change as the force is decreased? Does this differ between left and right sides?

- How does all the above compare athletes compared to non athletes?

- Use of the EMG Sensor with Qubit System's Hand Dynamometer.

The experiments described in (3) above may be carried out by investigating the muscles of the forearm while applying force to a Hand Dynamometer with the left and right hands. If increasing forces are applied to the Hand Dynamometer while monitoring the increasing EMG signal it should be possible to observe the recruitment of more and larger motor units as load is increased. Histogram analysis (menu command Insert>Additional Graph) can be used to sort the different sized pulses (i.e. action potentials) in the EMG signal. The motor units are de-recruited gradually at the end of the experiment if the load exerted on the hand dynamometer is slowly lowered.

(4) The EMG may be used as a guide to muscle relaxation via biofeedback.

Qubit Systems Warranty Information

QUBIT warrants all its instruments to be free from defects in materials or workmanship for a period of **one year** from the date of invoice/shipment from QUBIT. If at any time within this warranty period the instrument does not function as warranted, return it and QUBIT will repair or replace it at no charge. The customer is responsible for shipping and insurance charges (for the full product value) to QUBIT. QUBIT is responsible for shipping and insurance on return of the instrument to the customer. No warranty will apply to any instrument that has been (i) modified, altered, or repaired by persons unauthorized by QUBIT; (ii) subjected to misuse, negligence, or accident; (iii) connected, installed, adjusted, or used otherwise than in accordance with the instructions supplied by QUBIT.
The warranty is return-to-base only, and does not include on-site repair charges such as labour, travel, or other expenses associated with the repair or installation of replacement parts at the customer's site. QUBIT repairs or replaces the faulty instruments as quickly as possible; maximum time is one month. QUBIT will keep spare parts or their adequate substitutes for a period of at least five years. Returned instruments must be packaged sufficiently so as not to assume any transit damage. If damage is caused due to insufficient packaging, the instrument will be treated as an out-of-warranty repair and charged as such.
QUBIT also offers out-of-warranty repairs. These are usually returned to the customer on a cash-on-delivery basis.
Wear & Tear Items are excluded from this warranty. The term Wear & Tear denotes the damage that naturally and inevitably occurs as a result of normal use or aging even when an item is used competently and with care and proper maintenance.

Return Procedure

Before returning any instrument to QUBIT:
Consult the operating manual or contact Qubit to ensure that the instrument(s) is in fact faulty and has not just been set up improperly.
Contact QUBIT before sending anything back. We will issue an RMA number and provide shipping instructions. QUBIT will refuse any goods that are returned without an RMA number, or which are sent in a manner outside of QUBIT'S stipulations.
If you have encountered a program failure, we need a printed copy of any faults you have seen, including how to reproduce them. Include these in the return package along with your mailing address.
Include a copy of the Invoice on which the product was shipped to you.
All returns must be shipped prepaid. Unpaid packages will not be accepted.
In case of questions contact QUBIT by
E-mail: info@qubitsystems.com,
by phone: (01)-613 384 1977,
or by fax: (01)-613 384- 9118.