

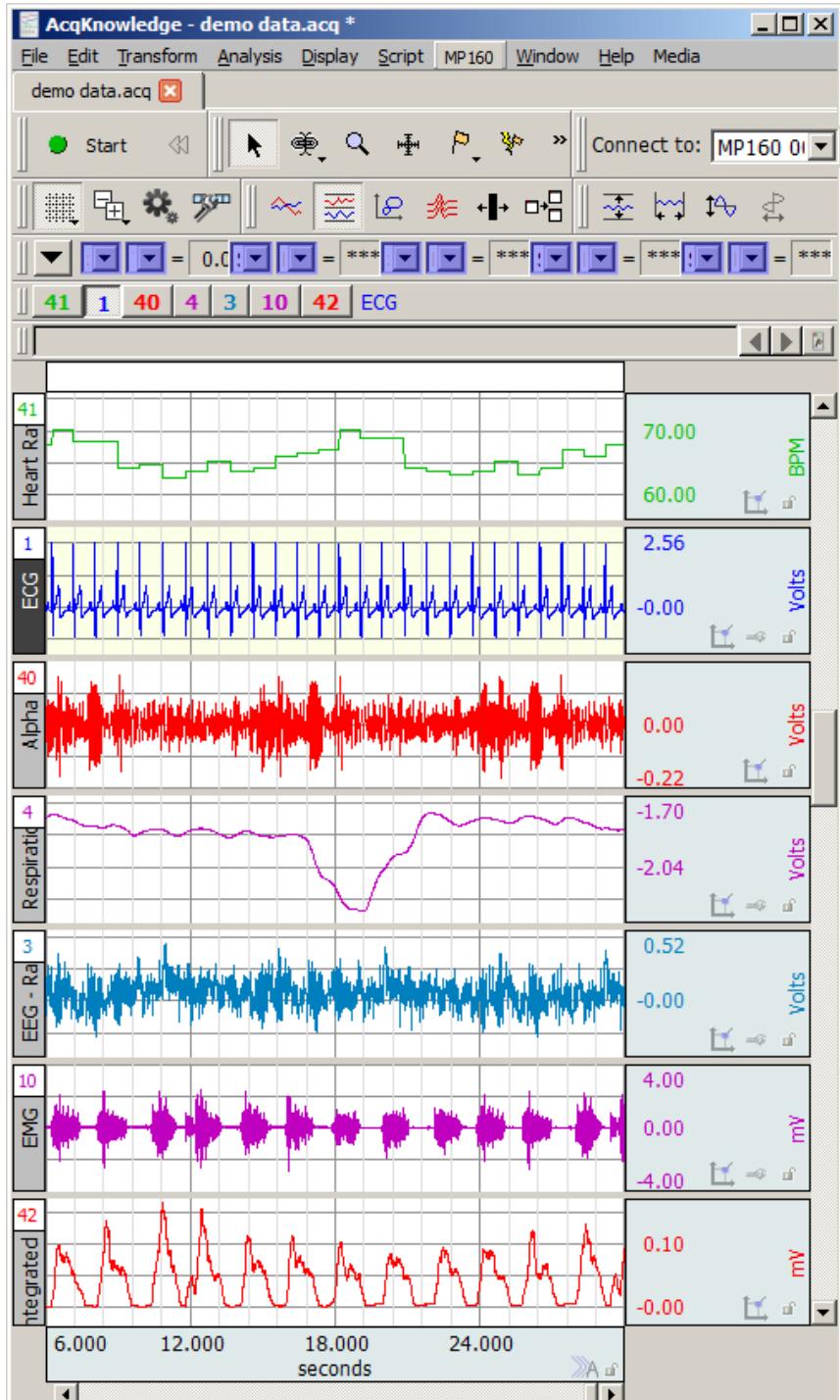


ACQKNOWLEDGE®

Tutorial

Congratulations on your BIOPAC Research System purchase and welcome to the global community of BIOPAC researchers and educators. This tutorial is designed to walk you through the basics of your *AcqKnowledge* data acquisition and analysis software, and includes a variety of prerecorded sample data files to simulate a live recording for demonstration purposes. While it is impossible to cover every feature of *AcqKnowledge* software in just a few pages, many questions can be addressed by combining this tutorial with our latest research catalog and the **AcqKnowledge Software Guide** and other online support documents (PDF format) provided in the **Help menu** and **User Support** folder installed to the *AcqKnowledge* program directory.

With this tutorial, you'll be able to simulate the use of the software for your particular application. *AcqKnowledge* is very flexible and there are usually many ways to perform different analysis functions. If you are unclear about how *AcqKnowledge* can address your specific requirements, please contact one of our Application Specialists for the most expedient solution, or visit BIOPAC's [Video Tutorial page](#) for instructional overviews of many analysis routines and software features.



Basic Questions

What is the MP System?

This tutorial and the accompanying demo data highlights the main features of AcqKnowledge by working through some common applications through the use of included sample data files. You'll examine specific sections, take readings, and perform analysis. Sample data files are included for: ECG data, EDA data, EEG data, EMG data, respiration data, and for use with the *Specialized Analysis Package*—Cardiac Output 1, EDA Events, RER, Cardiac Output 2. Also included are special measurement validation sample data files with spreadsheets configured to externally verify specific measurement data. All sample data files and preconfigured graph templates can be found in the Program Data > BIOPAC Systems, Inc. > AcqKnowledge 5.0 > Sample Data folder.

Hardware configurations



MP160 System



MP36R System

Workstations include:

- Data acquisition system that allows you to connect existing equipment such as pre-amplified electrodes, transducers, blood flow meters, force plates, and chart recorders
 - MP160 acquisition unit with High Level Transducer (HLT100C) module
 - OR*
 - MP36R four-channel data acquisition unit
- AcqKnowledge® 5.0 software

BIOPAC Systems, Inc. manufactures amplifiers and signal conditioning modules designed to measure an array of life science data including EMG, respiration, pulse, EEG, temperature, eye movement, skin conductance, evoked potentials, microelectrode recordings, electrical bioimpedance, laser Doppler flow, CO₂ and O₂ gas analysis, and electrogastrogram. We also offer a general-purpose amplifier that allows you to connect other devices, including bridge transducers like pressure, force, and strain gauges. In addition, you can mix and match amplifiers designed to collect specific kinds of physiological signals (such as ECG, respiration, and EMG). These modules snap together, allowing you to create a customized data acquisition workstation.

► See the full line of research products online at www.biopac.com.

AcqKnowledge® can be used with multiple MP160/150 data acquisition units to

- control multiple, independent experiments on one computer
- increase the total number of channels used for a single experiment (e.g., 32-channel EEG)

To synchronize the start of multiple units, use the External Trigger function. To combine up to 60 channels of data into one file, use the Merge Graphs feature. (See the AcqKnowledge Software Guide or video tutorials for details.)

Efficient Collection

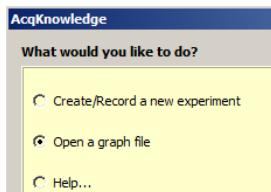
The MP System has several advantages over other recording systems. AcqKnowledge is extremely flexible, giving you full control over how data is collected. You can analyze data either while it is being acquired or after the fact. The AcqKnowledge software allows you to perform a range of measurements, calculations, and transformations after the data has been collected—most can be performed with a click or two of the mouse button. AcqKnowledge includes over 40 **Quick Start graph templates**, which include all the settings for a variety of experimental protocols (which are explained further in our **RESEARCH CATALOG**):

Let's begin...

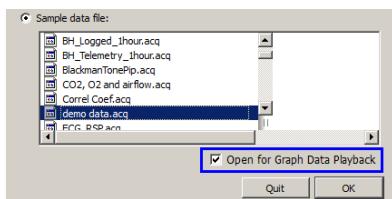
This tutorial demonstrates some of the basic features of the BIOPAC hardware and software. It assumes AcqKnowledge has been installed, your computer is connected to an MP System, and your KEYLOK license key is connected to a USB port. If not, please refer to your AcqKnowledge 5 Installation Guide.

To view example data display in a simulated recording, let's open the AcqKnowledge demo file for playback:

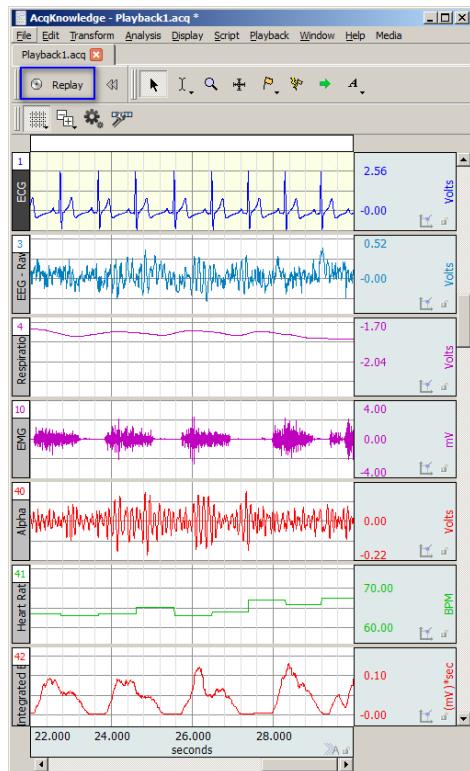
1. Launch AcqKnowledge by clicking the Desktop shortcut. A "Startup Wizard" will appear, offering a variety of program options.
2. In the Startup Wizard, select "Open a graph file."



3. Select the "Sample Data File" option. Highlight "demo data.acq" from the Sample data file list (you may have to scroll down) and check the "Open for Graph Data Playback" option.



4. Click OK. The selected file will open in the AcqKnowledge graph window.
5. Click the "Replay" button in the AcqKnowledge graph window.



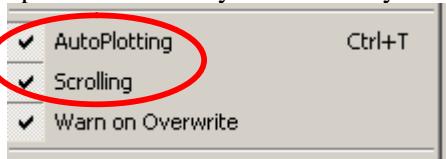
Pre-recorded data (taken from an adult male subject) will scroll across the graph window and the **Replay** button will be replaced by a **Stop** button while the playback is in progress. This is a simulated real-time data display replicating an actual physiological recording. Data will be "collected" for 30 seconds—the replay can be interrupted at any time by clicking the **Stop** button.

After completing (or stopping) the playback, click "Replay" again to repeat the simulated recording. (Click "Yes" if prompted to overwrite the existing data.) The replay will be identical in appearance and length to the previous data display.

- Click the grid icon  on the toolbar to toggle the grid display.
- Use the Zoom tool  on the toolbar to enlarge an area of data.
- Use the I-beam tool  to select an area of data.
- Use the Data Acquisition Setup window to modify the duration and recording mode of the replay (Playback > Set Up Data Acquisition > Length/Rate). The duration can be increased or shortened, and the acquisition modes changed. (See page 6 for more details about acquisition setup.)

During recording (or playback of data); note when the data plot reaches the right edge of the window, the waveforms begin continuously scrolling from right to left. For long recordings, it may be desirable to view the data collected earlier in the acquisition while new data is coming in.

To demonstrate this, disable the **AutoPlotting** and **Scrolling** options on the Playback menu by unchecking the boxes.



Replay the acquisition again.

Now, when the data plot reaches the right limit, the screen will not be re-written, but the horizontal scroll bar will shift to indicate that the file length is longer than the visible display.



At this point, you can use the horizontal scroll bar to look back through the data. Note that the scroll bar position indicator is changing while data collection is in progress. This indicates that the record is getting longer as new data is being acquired. You can reselect **AutoPlotting** to again view the new data as it is acquired, and **Scrolling** as desired.

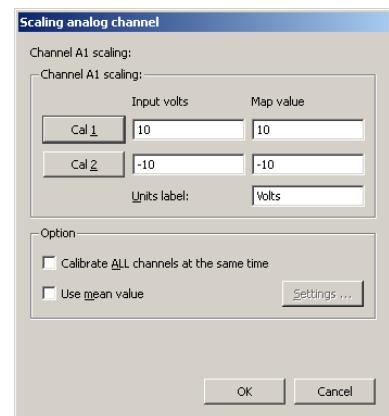
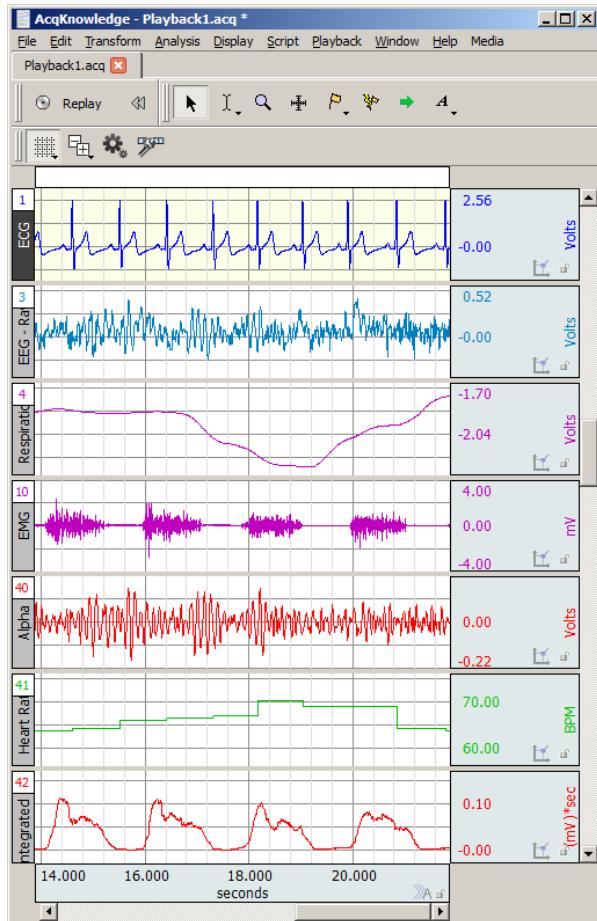
During long recordings, you may wish to do other tasks on the computer. By minimizing or resizing the window, the MP System can be busy collecting data in the background while you're using another program. The MP System software will never miss any data.

In addition to the ability to collect data in the background, AcqKnowledge also gives you total control over the channel acquisition parameters. To illustrate this, choose **Set Up Data Acquisition > Channels** from the Playback menu. To the left of each channel, the **Acquire** checkbox enables acquisition, and the **Plot** checkbox enables plotting. If **Acquire** is on but **Plot** is off, data from that channel will be recorded, but not plotted on the screen. After the data is recorded, you can turn the channel plotting on by pressing the **Option** (Mac) or **Alt** (PC) key and clicking in the channel boxes at the upper left of the graph window.

The **Values** checkbox will cause the channel's current value to be numerically displayed in the **Input Values** window. When a channel row is selected, you can set scaling and other parameters. You can edit each channel **Label** as desired.

Calculation Channel **Presets** offer an easy way to apply filters, expressions or transformations to data in real time. Click the **Calculations** tab in the **Set Up Channels** dialog to activate the **Presets** menu. Click the (arrow icon) to generate a list of preset options. Use an existing preset, or modify it to create a new one. Then, organize the channel presets (via the Playback menu) to suit your needs. Calculation Presets can only work in conjunction with Analog input presets, or with other calculation channels that are ultimately pointing to an Analog source channel. Use **Playback menu > Set Up Data Acquisition > Channels > Setup** to set the Source for a Calculation channel.

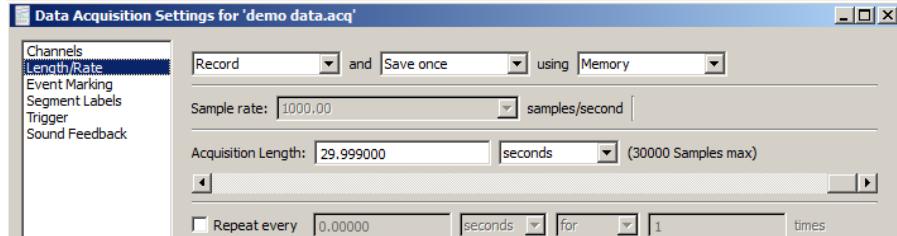
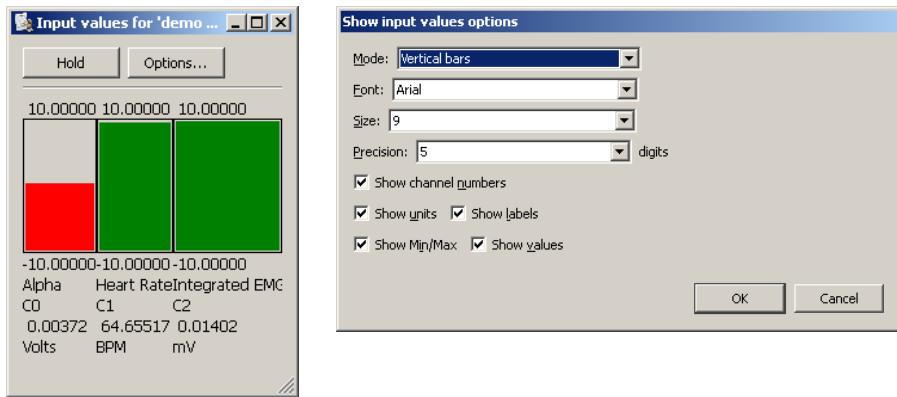
You can easily translate the voltage read by the MP hardware into the units of the device being measured. Click the **Analog** tab in the **Set Up Channels dialog** and click the **Setup** button to generate the **Scaling** dialog. Enter values and a units label to convert incoming signals into other units (such as ft/lbs, millimeters, liters, etc.).



To view the input channel values in numerical and/or bar chart format, choose **Show Input Values** from the Playback menu. This type of data display is useful for biofeedback procedures.

Click **Options** to generate controls for the size, precision, and format of the values in the **Input values** window.

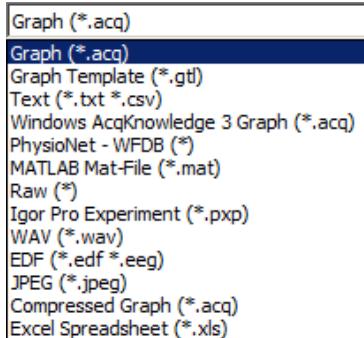
To further control the acquisition, select **Set Up Data Acquisition** from the Playback menu and choose **Length/Rate** to generate the **Acquisition setup** dialog. This is where you will set up parameters that control data collection. The basic options are **Acquisition Sample Rate** and **Total Length**.



- **Sample Rate** sets the frequency at which the data is being recorded in samples per second (Hz). Normally you would choose a samples/second rate from the pull-down menu but this menu is disabled for the demo, which is locked to an acquisition sample rate of 1000 samples/second.
- **Acquisition Length** sets the duration of the recording. Adjust the scroll bar or enter the length value directly.
- Units for the length can be set to samples, msec, seconds, minutes, or hours by clicking the pop-up menu to the right of the Total Length value.
- **Repeat every** is used to set up single or multiple consecutive acquisitions at a user-defined time interval.

Restarting the acquisition by clicking the **Replay** button will apply any modified settings, although, as previously stated, the demo is locked to an acquisition sample rate of 1,000 samples/second. The parameters can also be set to store data to **memory**, **disk**, or **MP160/150 unit**, or, for more sophisticated acquisitions, use signal averaging, **Averaging** (the demo is locked to Memory). Any storage medium a file can be copied to can be used (including removable hard disks and flash drives). For most applications, the MP System is limited only by the computing environment (system speed, available memory, etc). **AcqKnowledge** will only let you enter valid parameters.

All acquisition parameters and window positions are saved along with the data when the **Save** command is chosen. This feature allows you to open a data file and collect new data without having to reset any parameters. **Save As** options include



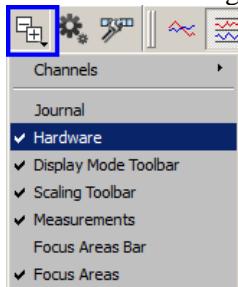
- **Graph (.ACQ)** saves data in a binary file format that uses minimal disk space.
- The powerful **Graph Template (.GTL)** feature lets you save predefined experiment parameters. Just open a **Graph Template (.GTL)** and click **Start** to recreate the protocol and acquire data under the same settings. **Quick Start** Graph Template files are available for dozens of applications and can be used as a starting point for customized applications. A sample **Quick Start** file is installed with the Samples folder (open as Type: Graph Template).

- **Compressed** will generally achieve about 60% compression. Saving small files (less than 200K) may have little effect.
- **Text (.TXT)** is a standard ASCII format that can easily be read by other programs.
- **JPEG** files can be read by most drawing and word processing programs.
- **Matlab** uses the öMAT-fileö binary format to save numerical and textual information as **Filename.mat**.
- **Excel Spreadsheet File (.XLS)** option saves graph data with each channel placed into a spreadsheet column.
- **Raw (.RAW)** saves data for low-level data exchange with options for data type, layout, and endian byte ordering.
- With **Igor Pro Experiment format (.PXP)**, the graph is saved to a single packed experiment file, with each channel saved into a separate Igor wave that preserves the channel label, waveform sampling rate, and unit information.

Easy Viewing

The AcqKnowledge software makes it easy to display and view your data. The software is designed to provide a clear interface for working with data and displaying information. AcqKnowledge includes...

- On-screen measurement tools that can be used to instantly find a host of measurements, including minima, maxima, intervals, BPM, and more.
- Functions that allow you to superimpose, tile, compress, expand, duplicate, or remove waveforms.
- Editing features allow you to cut, copy and paste data using familiar commands.
- Built-in ability to view several files on the screen at the same time.
- Printing utilities that allow you to produce high-resolution plots.
- Use the display toolbar button to quickly turn on/off elements and tools in the graph display.

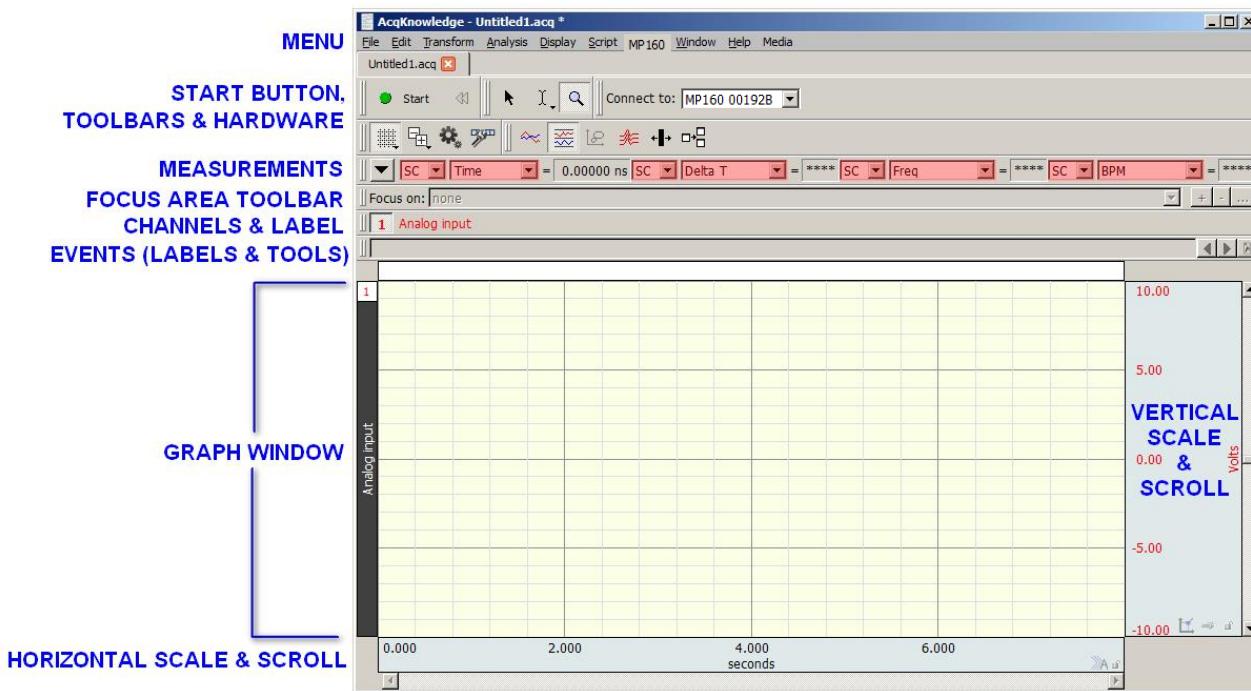


In the upper portion of the acquisition window, a row of small boxes indicate the acquired channels.

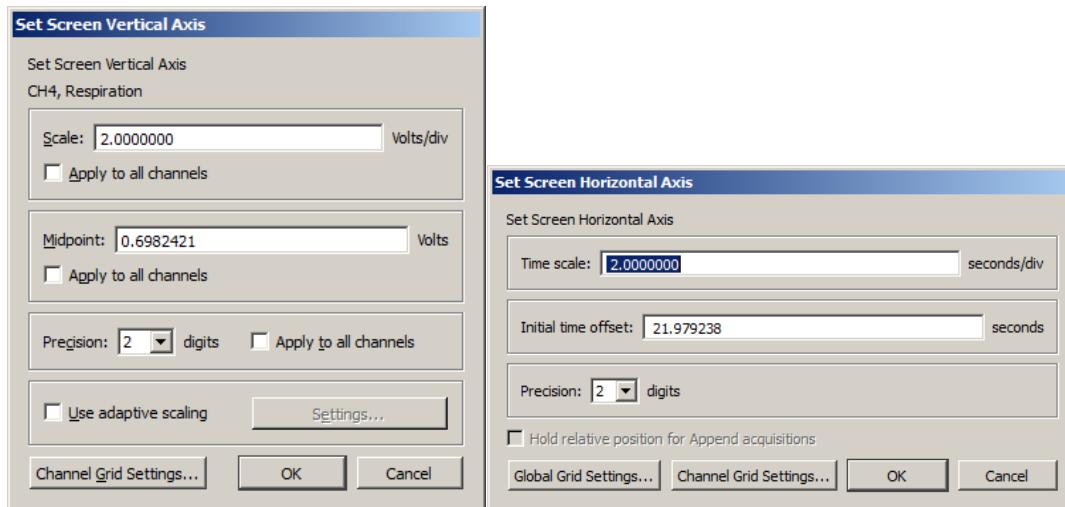


The box on the left corresponds to the waveform at the top of the screen. The box that appears depressed is the selected (or öactiveö) channel. Only one channel can be selected at a time. The color of each channel's waveform and indicator box correspond and can be changed. Measurements can be taken from any channel, while transformations and editing operations apply to the selected channel or, in some cases, to multiple channels. To select a channel, click the waveform using the arrow tool. The axis Grid Locks(s) must be locked for the Grid Tool to function on a channel.

The label of the selected channel appears to the right of the channel indicator boxes. The vertical scroll bar adjusts the vertical offset of the selected channel. You can use it to slide the selected waveform's scale up or down.



To adjust the vertical scale of the selected channel, click the vertical scale & scroll region. The vertical scale dialog box will appear. Type in a value roughly half the current value and click **OK**. The selected waveform's screen amplitude will now be twice as large as it was before. You have independent control over each channel.



To display the optimal vertical scale for all channels, choose **Display > Autoscale waveforms**. (The Autoscale option can also be accessed by right-clicking inside a channel area on the graph.)

You can also compress or expand the displayed waveforms along the horizontal (time) axis. Simply click anywhere in the horizontal scale region. The horizontal scale box will appear, allowing any entry. After clicking **OK**, the screen will be redrawn with the new time scale setting.

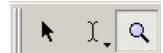
You can temporarily hide channels by clicking a channel's indicator box (in the upper left of the graph window) while holding down the **Alt** (PC) or **Option** (Mac) key. The box will be slashed, and the display will be redrawn without this channel. Repeating this operation will cause the waveform to reappear. Multiple channels can be hidden.



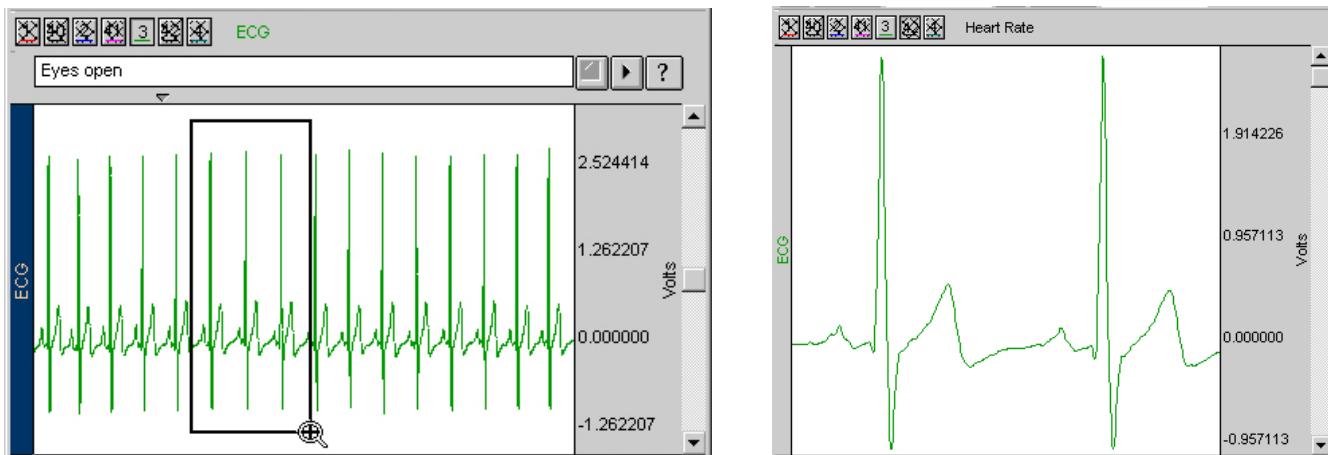
Channels can also be hidden by clicking the **⊖** button in the upper left of the channel label and unhidden by clicking the **⊕** button.



To enlarge a section of interest, use the zoom tool in the cursor toolbar.



The zoom tool allows you to select any section of data and enlarge it to examine that area in more detail. To do this, click the zoom tool and then click and drag the mouse so it forms a box over the desired area. Now, release the mouse button and you will instantly see the enlarged area (example follows).



Select **Zoom Back** and **Zoom Forward** from the **Display** menu to move through zoom levels. (Or use the keystroke combination **Ctrl+** or **Ctrl-**.)

None
Value
Delta
P-P
Max
Min
Mean
StdDev
Integral
Area
Slope
Lin_reg
Median
Time
Delta T
Freq
BPM
Samples
Delta S
Median T
Max T
Min T
Calculate...
Correlate
Skew
Kurtosis
Moment...
Cap_dim...
Corr_dim...
Inf_dim...
Lyapunov...
Mut_inf...
Expression...
NLM...
Evt_count...
Evt_loc...
Evt_ampl...

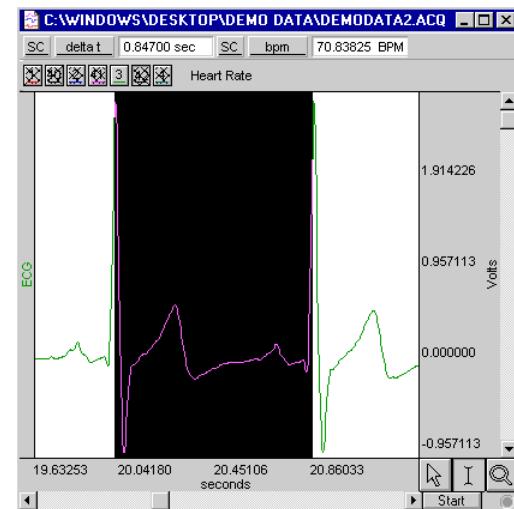
To duplicate or remove a selected waveform, choose **Duplicate** or **Remove waveform** from the **Edit** menu.

To take specific measurements, click the I-beam selection tool in the lower corner of the window. Select a section of the data by clicking and dragging the cursor across a waveform as shown at right.

In the example at right, the interval between two peaks is selected. The two peaks occur **0.847 seconds** apart, which results in a **BPM of 70.83825** as indicated in the second result window.

The sample data window shown at right has two measurement popup menus at the top of the window.

To change the measurement functions, simply click the popup menu next to the measured value and select a different measurement. To change the channel each measurement is based on, choose from the **SC** popup menu. By default, measurements are taken from the selected channel (as indicated by **SC**).



The values will change while the measurement tool is being dragged over the waveform. You can easily measure absolute functions like value, time, and sample number or use functions that operate over the highlighted area. These include min, max, mean, Delta T, and others.

The measurement features can be automated so that measurements are taken and pasted into the Journal file when a specific event occurs or at pre-specified, user-selectable time intervals. The **Find Cycle** function (under the Analysis menu) will identify specific events based on a variety of threshold and window discriminators or allow you to enter a time period. In the time period mode, the software will take the chosen measurement at the defined interval.

The measurement tool is also used to edit waveforms. The highlighted area can be cleared, cut, copied, or pasted. Data is edited from the selected waveform only. You can copy a section of one waveform and paste it into another by selecting the destination waveform before pasting it. You can also perform edits (such as pasting) between windows. To copy an entire waveform from one window to another, choose **Edit > Select All** and then choose **Edit > Copy**, and then switch to the other window and choose **Edit > Insert Waveform**.

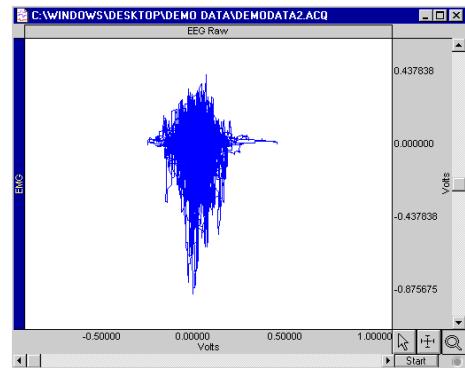
Choose **Display > Preferences > Measurements** or click the toolbar's **Preferences** button to modify the measurement display parameters.

AcqKnowledge offers a number of display options, including **X/Y plotting**. You can switch from one display mode to another using the toolbar icons in the upper left hand corner of the window.



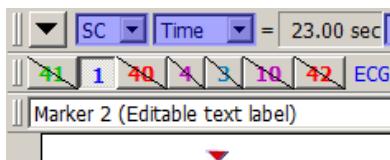
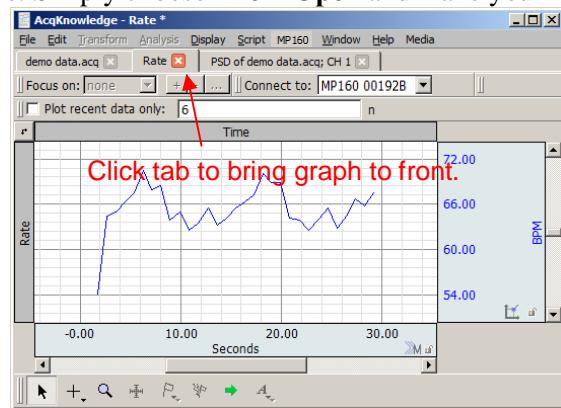
Scope, Chart, X/Y, and Overlap display mode icons

By clicking these icons, your display can alternately emulate a chart recorder or oscilloscope, or you can plot data from one channel against data from another channel. You can also overlap appended data segments to simplify comparison (requires acquisition setup for append). X/Y plots are useful for respiration studies, vectorcardiograms, and investigations into non-linear dynamics.



The software allows you to display several files on the screen at one time. Simply choose **File > Open** and make your selection. The windows can be displayed as windowed or tabbed, and moved and resized to ease in viewing. Clicking on the window or tab brings it to the front. This is very useful for comparing files.

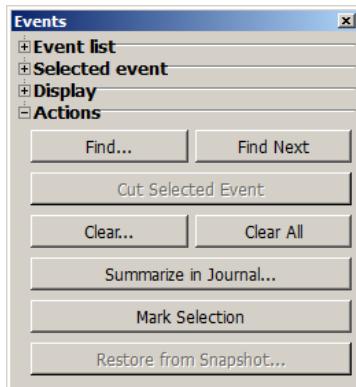
- For more detailed display options, read about modes and Data Views in the AcqKnowledge Software Guide available under the software Help menu.



For some experiments, you may need to mark when an event occurs. To do this, use the on-screen event marker feature. With an open graph window (in Chart or Scope mode), choose **Display > Show > Events** and **Display > Show > Event Bar** to activate the event marker display region near the top of the graph window. A wide range of event types can be added by clicking the toolbar button, selecting an event type and clicking on the event region just above the graph data. To remove an event, click the toolbar button and click on the event to be removed.

Each event marker is represented by an icon and can be annotated with text. To add a new event marker after acquisition, position the cursor in the space between the bottom of the marker region and the top of the graph and click the mouse.

To enter a global event marker during an acquisition at exactly the time the key is pressed, use **Esc**. Use the event marker tools to jump through the event markers or generate a popup menu that will allow you to search for or delete specific event markers.



Event markers can be positioned in the event marker bar, on the waveform, at the top of the plot, on the waveform with an indicator, or on top of the plot with an indicator. Click the Event Palette icon on the right edge of the Event Tools to review event marking options .

See the [AcqKnowledge Manual](#) under the **Help** menu for Event setup, control, and measurement options, including Hotkey setup and automated detection.

Read in the complete [AcqKnowledge Manual](#) available under the Help menu for more tips!

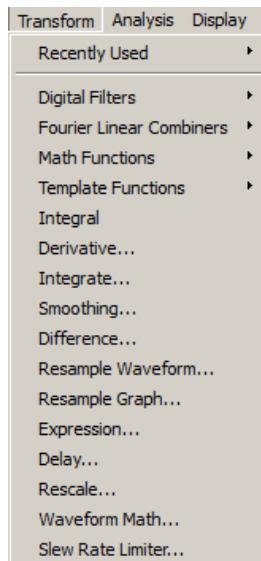
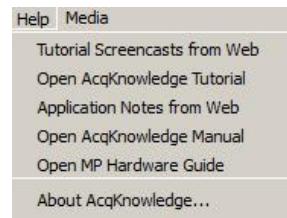
Powerful Analysis

One advantage of saving data on disk is that you can quickly and easily perform post-acquisition analyses on your data. AcqKnowledge is as powerful an analytical tool as it is flexible. What's more, the software is designed to provide you with immediate feedback from each operation. Using AcqKnowledge, you will be able to...

- Use digital filtering and smoothing.
- Find patterns within data sets.
- Automatically find cycles/peaks and calculate rate data.
- Perform mathematical and statistical operations.
- Log results and observations to a journal.
- Mark events during acquisition or analysis.
- Transform data after it has been acquired.

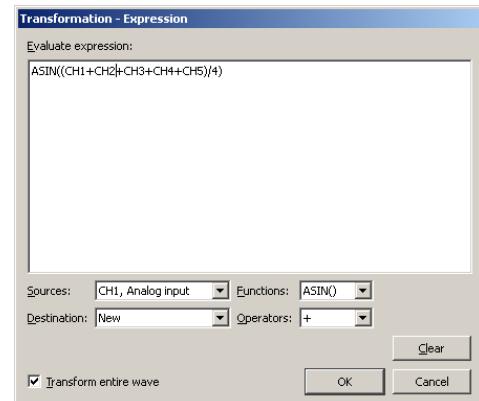
Read more about analysis, transformations and event marking in the complete [AcqKnowledge Manual](#) available under the **Help** menu.

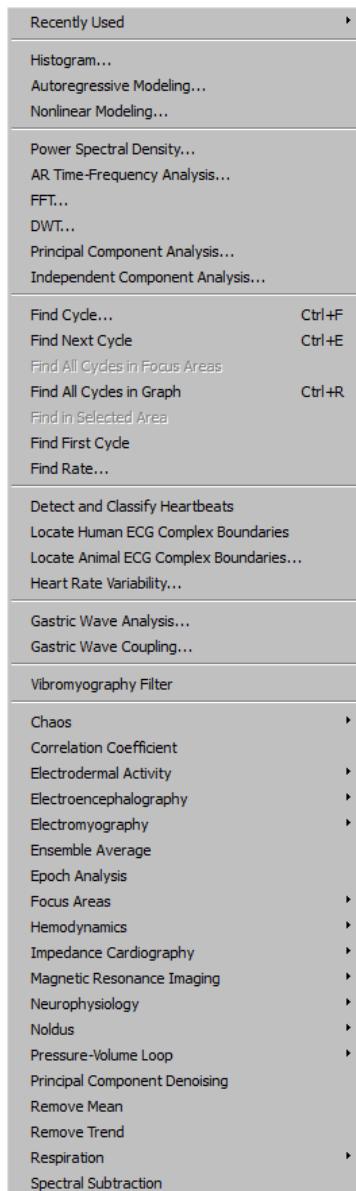
View video tutorials and software overviews **online** at www.biopac.com/videos.



The **Transform** menu contains operations that modify the data in the graph after the recording is completed and opened for analysis.

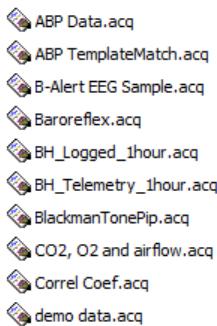
- **Digital Filter** has a sub-menu with both FIR and IIR types of filter operations. For most datasets, the default filter parameters may be used and will produce relatively robust results.
- **Math Functions** has a sub-menu with several mathematical transformations; some transformations will produce a dialog with parameters that can be changed.
- **Template Functions** has a sub-menu with options to examine the relationship between two different waveforms.
- **Integral** results in a running total of all selected waveform values (using trapezoidal rule integration).
- **Derivative** approximates an ideal differentiator. It allows you to specify a low pass frequency to filter the data prior to performing the derivative.
- **Difference** is a running subtraction over the number of points specified.
- **Expression** provides a range of mathematical operations from addition and subtraction to arcsine and log transformations to perform complex operations in a single step. For example, compute the mean of channels 1, 2, 3, 4 and 5, and then arcsine transform the result. Save the output on a new or existing channel. Transform the entire waveform or a selected area.





Watch detailed Find Peak/Find Rate video tutorials online at www.biopac.com/videos

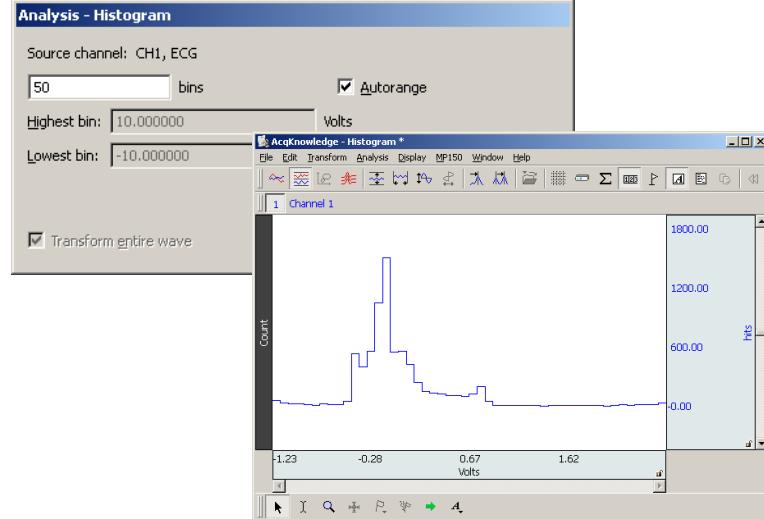
Use over 50 **Sample Data** files to further explore the power and flexibility of AcqKnowledge software, including the analysis automation tools.



The **Analysis** menu contains operations that derive data and measurements from the graph.

- **Histogram** allows you to display data in summary format and examine the central tendency characteristics and variability within a waveform.

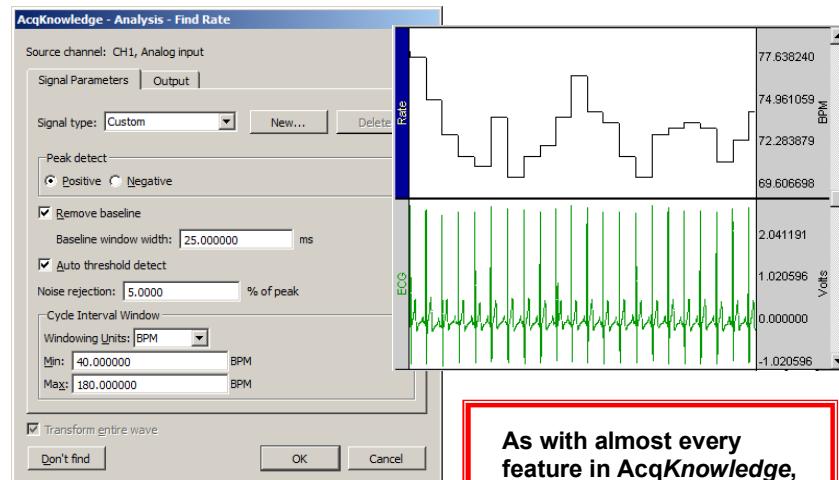
- Enter the number of bins to sort the values into. For example, type 50 in the bins entry and click **OK**. To set the upper and lower bounds of the data to be sorted, disable Autorange.



- **Find Rate** will search for cycle or peaks and calculate rate information. For example, it will calculate BPM for the entire ECG waveform.

- Operate as a simple threshold detector or include more sophisticated parameters such as noise rejection and windowing.
- Calculate the following parameters from a variety of cyclical data: BPM, Hz, peak max, peak min, P-P, area, and mean.

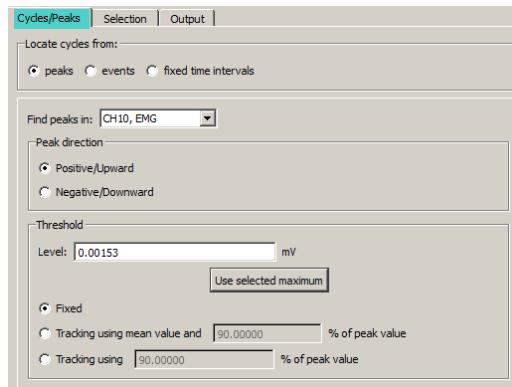
By default, AcqKnowledge will automatically calculate the threshold values and compute the rate for the entire waveform, but you can limit the transformation to a selected area.



As with almost every feature in AcqKnowledge, you can experiment with different settings to suit your needs.

Sample Find Cycle Analysis:

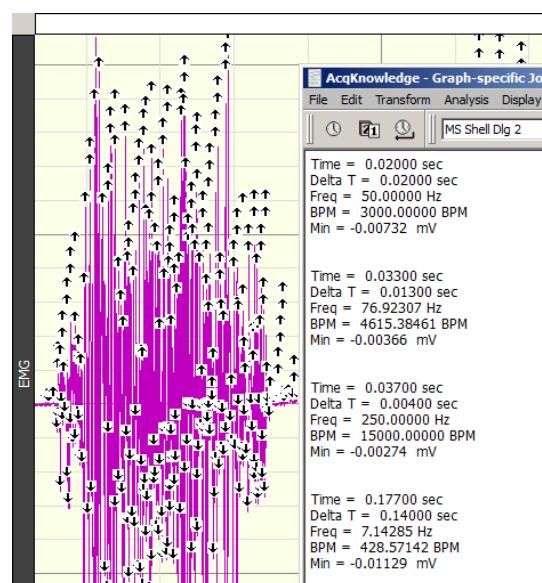
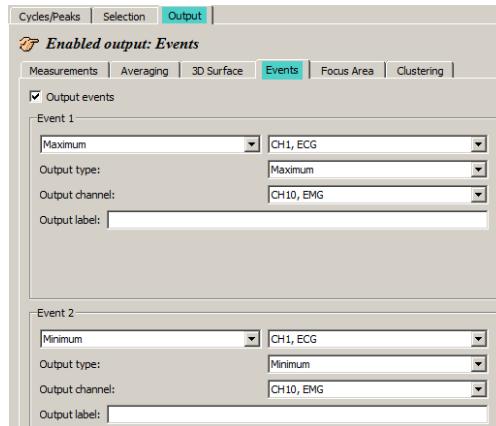
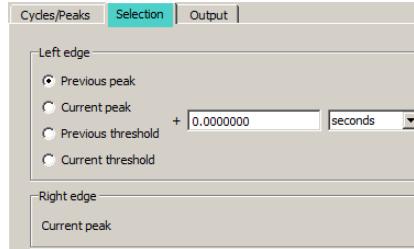
1. Hide all channels except CH 10 EMG. 
2. Zoom in on a burst in CH 10 EMG and then use the I-beam cursor to highlight the area around one typical EMG spike.
3. Select **Ctrl-F** (or **Analysis > Find Cycle**) to generate the Cycle/Peak Detector dialog.
4. Click the **Cycles/Peaks** tab and set the Threshold Level by clicking the **Use selected maximum** button under the entry box.
5. Click the **Selection** tab and set Left edge to Previous peak.



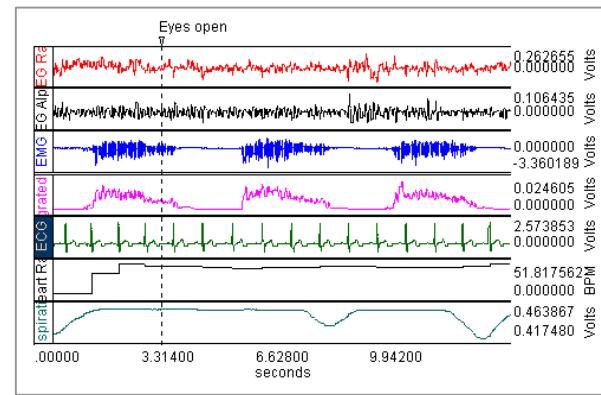
6. Click the **Output** tab.
 - Select the Measurements tab and click **Paste measurements for each cycle to Journal**.
 - Select the **Events** tab.
 - i. Check the **Output events** box
 - ii. Set Event 1 to Maximum on CH 10 EMG for Output type General > Maximum and output on CH10.
 - iii. Set Event 2 to minimum on CH 10 EMG for Output type General > Minimum and output on CH 10.
7. Click **OK** to close the dialog.
8. Click **Find All In Graph**.
 - Click **Yes** if prompted to create a Journal.
9. Scroll left to the start of the data file.
10. Use the Zoom tool to examine event definition and placement.
11. Click or display journal to review pasted event text.

Click [here](#) to watch a web screencast of various Find Cycle operations.

Read more about transformations and event marking in the complete **AcqKnowledge Manual** available under the **Help** menu.



You can print out waveforms as seen on the screen by selecting **File > Print**. The AcqKnowledge software supports standard output devices (printers, plotters) and can produce high-resolution plots on virtually any printer.



AcqKnowledge also includes tools that allow you to work more efficiently. One such tool is the **Stimulator Setup** dialog, which is useful for creating stimulus signals and other types of output signals.

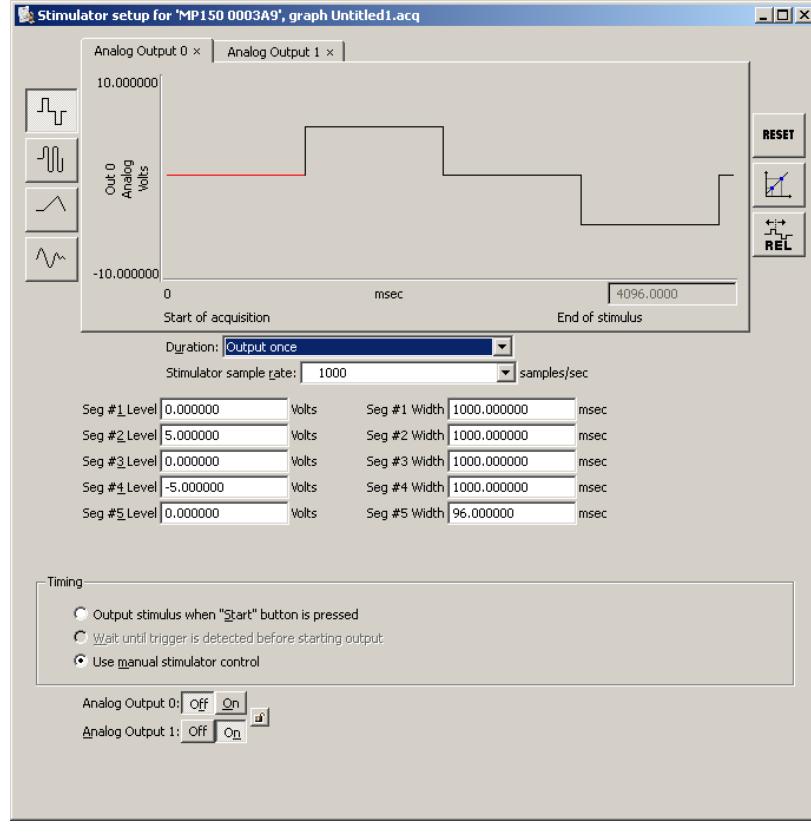
The Stimulator Setup dialog allows you to choose from a number of *pre-shaped* waveforms, including pure tones, square waves, and ramp waves. You can also use the arbitrary waveform option to output more complex waveforms.

To see this feature, exit Playback Mode (MP160/150 > Exit Playback Mode) and close the demo file. An MP160/150 connection is required to enable all options.

Choose **MP160/150 > Set Up Data Acquisition > Stimulator**. Select **Output once** from the **Duration** menu.

This enables the output options and displays a square wave (which is the default). You can easily change the type of output waveform by clicking the Waveform icons in the dialog box. To alter the characteristics of the signal (duration, amplitude, magnitude, frequency, phase, etc.), type in new values in the text boxes below the waveform or drag a waveform segment in the dialog display.

For AcqKnowledge with MP36R hardware, stimulator functions are controlled via the MP > **Output Control** menu. For further details on using this feature, see the *AcqKnowledge Software Guide*.



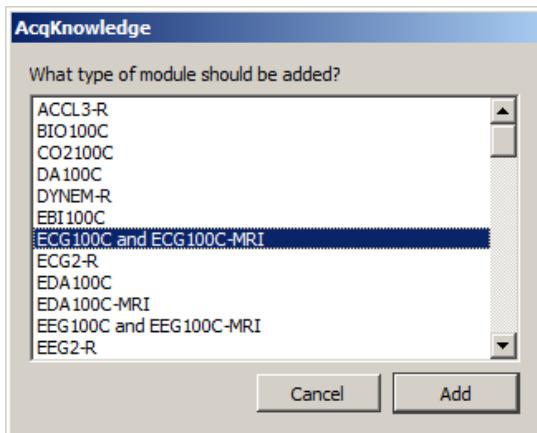
Setting Up to Record Data

1. Exit Playback Mode by choosing **MP menu > Playback > Exit Playback Mode.** The **Playback** menu item will revert to show the currently-connected MP hardware type and the **Replay** button will be replaced by the  **Start** button. (Transducers, MP Hardware and associated amplifiers must be connected to record physiological data. See the MP Hardware Guide and AcqKnowledge 4 Software Guide for details about setup for the type of data you wish to collect.)
2. Close the Demo Data file by clicking the graphs **close** button (X) or by choosing **File > Close.**
3. Choose **Create/Record a new experiment** in the Startup Wizard.

For MP160 and MP150 hardware, AcqKnowledge features a module-oriented setup option called **View by Modules**. In this mode, guided prompts show the user to add modules/transducers and establish necessary parameters. In addition, the module setup detects potential channel conflicts between the software channel assignment and the module's channel switch setting, and scales the signal to the correct value and units. This module setup mode is presented by default when AcqKnowledge is launched using the **Create/Record a new experiment** option. This can greatly assist in expediting proper setup of the connected BIOPAC equipment.

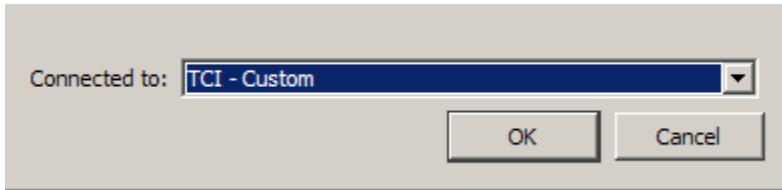
If desired, you may cancel guided module setup and choose the  **View by Channels...** option to set up the acquisition and graph channels manually. For more details, see page 15. To continue with guided module setup, go to Step 4.

4. Select a module and click **Add**. (The ECG100C module selected below is an example only. It may not match the module you are using.)



For a video overview on setting up channels for wired, wireless, and specialty amplifiers visit our [YouTube channel](#) for online tutorials.

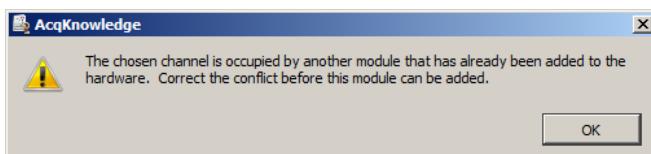
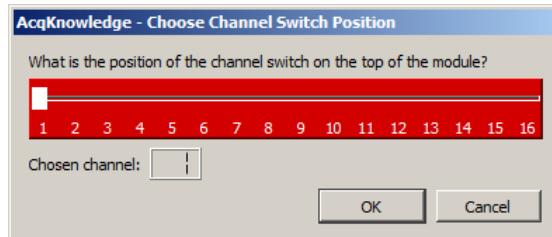
5. If prompted, select a transducer and click **Add**.



6. If prompted, input the channel switch settings from the selected module.

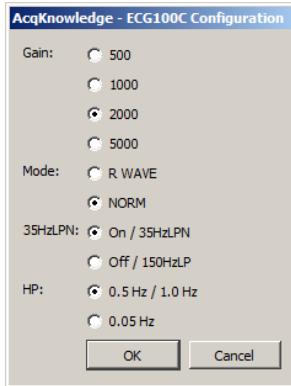
Set the choose channel switch to the number set on the top of the module (some modules, such as the OXY100C, have a switch on the front).

Setup detects any potential channel conflicts between software assignment and the module's channel switch position (see below warning dialog).

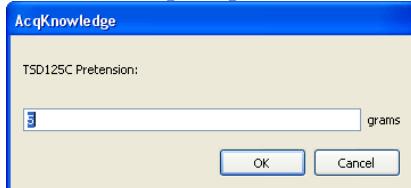


7. Establish the configuration for gain and filters as shown on right and click OK. It is important to set the Gain and Filter settings to match the switch settings on the amplifier. The software uses this information to scale the signal to the correct units. If the Gain is not set to match, the signal will be scaled incorrectly.
8. Perform calibration steps, if required. The software will automatically scale certain signals if they only require a zero setting. However, some signals require a two-point calibration. In this case, the software will generate additional prompts for the scale values.

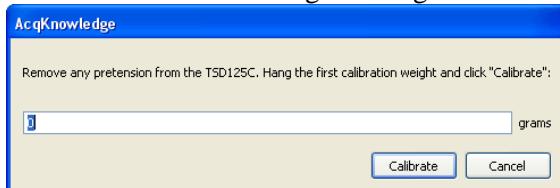
The following example shows the dialogs for setting up a TSD125 force transducer.



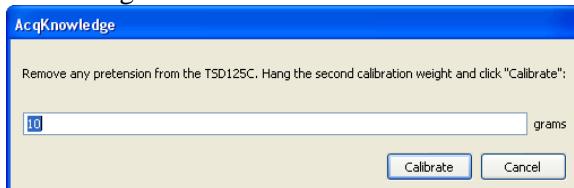
- a. The software prompts the user for pretension amount; enter 00 if pretension is not required.



- b. Enter a low calibration value or 00 if calibrating between zero and a second weight, and then click 'Calibrate' to take a voltage reading.



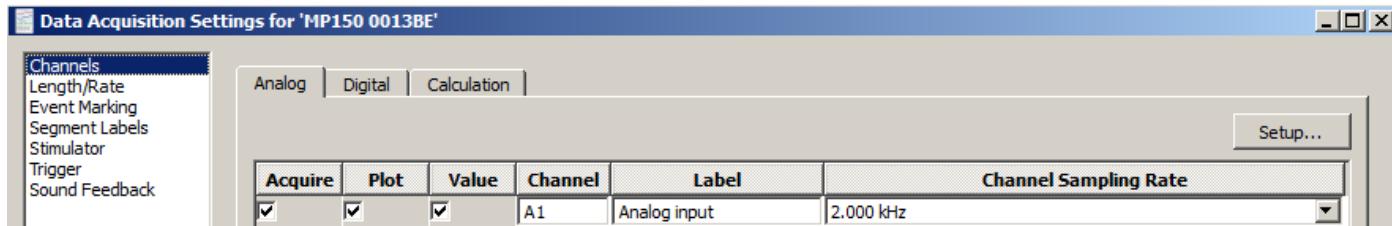
- c. Enter a high calibration value and then click Calibrate to take a voltage reading.



Note: When recording is started, the data may show an offset. This offset is the amount that was entered in the pretension dialog. Adjust the tension applied to the transducer to center the signal on zero.

Using this information, the module setup automatically sets the scaling and initial visual range to match the physical input units from the module or transducer.

The manual set up option is **View by Channels...**. In this display, three columns of boxes appear next to text boxes describing the channel, label and sample rate information. To collect and plot sample data for a given channel, enable the **Acquire** and **Plot** columns for that channel. Then add any Calculation channels and set the Length/Rate (acquisition parameters) as desired. Once established, you are ready to record using those parameters.



Please contact us to discuss how BIOPAC can provide you with solutions for life science data acquisition and analysis, or visit our website at www.biopac.com. Please also visit the [Demo Video and Tutorial Screencast](#) section of the website for comprehensive video tutorials and hardware demos.