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AcqKnowledge® 5

Demo Guide

Thank you for downloading the AcqKnowledge Demo Software!

This functional and informative Demo version is designed to introduce you to the power of AcqKnowledge data acquisition and analysis software, and includes a wide variety of prerecorded sample data files for simulating live recordings.

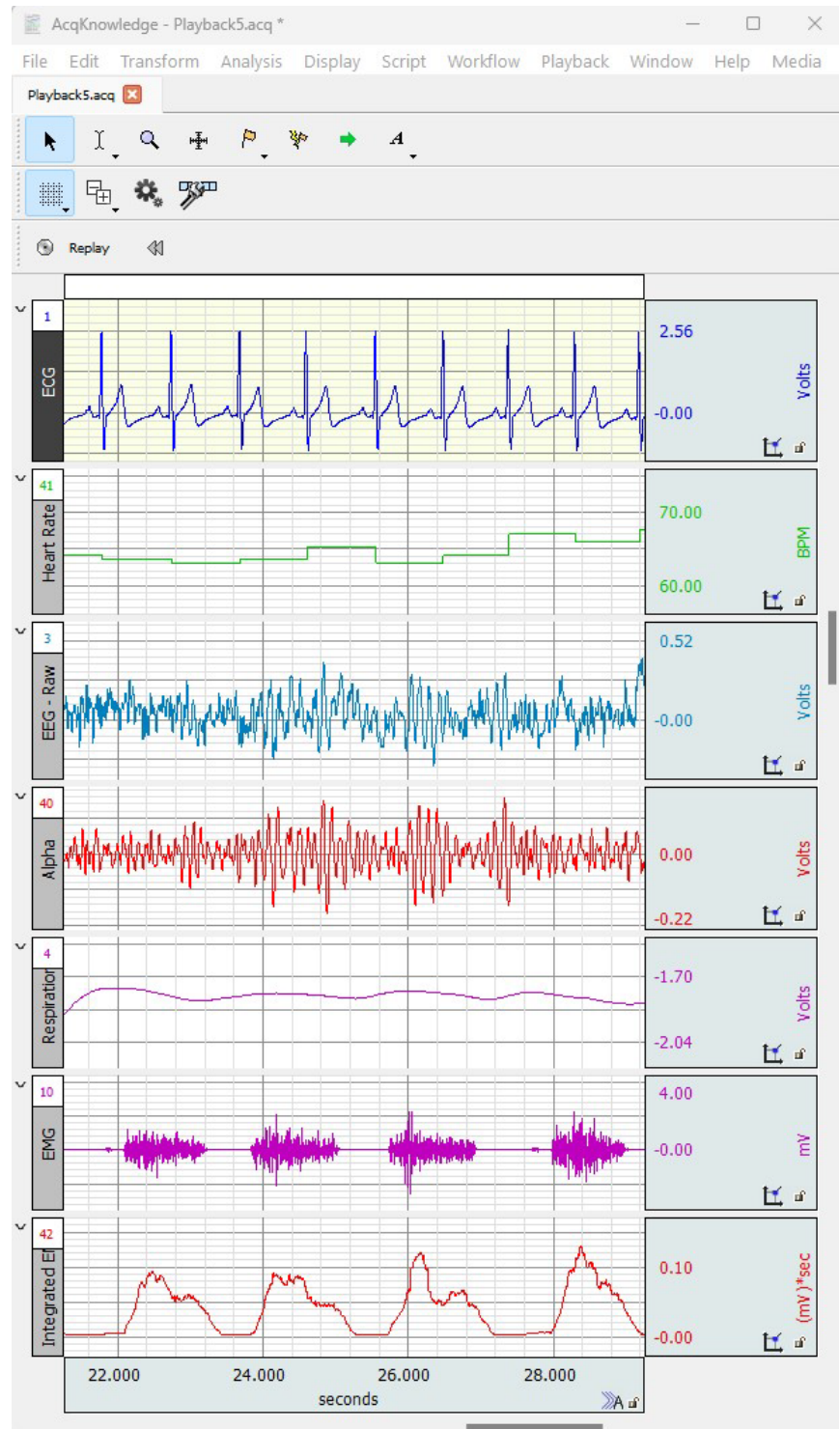
Note that the following full-version AcqKnowledge features are disabled in the Demo version:

- Recording of live data or external hardware support.
- Saving or printing of files.
- Compatible file types are limited to graphs (*.acq) or graph templates (*.gtl).

However, most of the feature-rich tools included in the full AcqKnowledge software version are intact in the Demo, which allows you to explore these remarkable options using any of over 50 available sample data files. While it's difficult to cover every feature of AcqKnowledge software in just a few pages, in-depth questions can be addressed by combining this tutorial with our latest research catalog, the "[AcqKnowledge Software Guide](#)," and other support PDFs provided in the Demo's Help menu.

With this guide, you'll be able to simulate hands-on use of the software for your particular application. For more information about how AcqKnowledge can address your specific requirements, please contact one of our Application Specialists at www.biopac.com.

For in-depth overviews of the analysis routines and other powerful software features available in AcqKnowledge, we encourage you to visit BIOPAC's Video Tutorial page at: www.biopac.com/videos.



Basic Questions

What is the BIOPAC MP System?

The BIOPAC MP System includes all necessary hardware and software for efficient collection of physiological data, with packages completely scalable to your needs. BIOPAC also manufactures industry-leading 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 supports connection to other devices, including bridge transducers like pressure, force, and strain gauges. In addition, you can mix and match amplifiers designed to collect specific and varying physiological signal types. These modules snap together, allowing you to create a customized data acquisition workstation.

This guide and the accompanying Demo software will highlight the main features of AcqKnowledge software using the included sample data files. You'll examine specific sections, take readings, and perform analysis. Over 50 sample data files are included for ECG data, EDA data, EEG data, EMG data, respiration data, and much more. For use with the *Specialized Analysis Package*—Cardiac Output 1, EDA Events, RER, Cardiac Output 2, Noninvasive Blood Pressure, Impedance Cardiography, and more. Sample data files and preconfigured graph templates can be accessed via the AcqKnowledge Demo's clear Startup Wizard interface.

Hardware configurations



MP160 System



MP36R System

BIOPAC's Research Systems include:

- Data acquisition system that allows for connection of existing equipment such as pre-amplified electrodes, transducers, blood flow meters, force plates, and chart recorders
 - MP160 16-channel acquisition unit with High Level Transducer (HLT100C) module
- OR
- MP36R 4-channel data acquisition unit
- AcqKnowledge® 5 software (*Note that AcqKnowledge 5 is supported in 64-bit OS only.*)

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

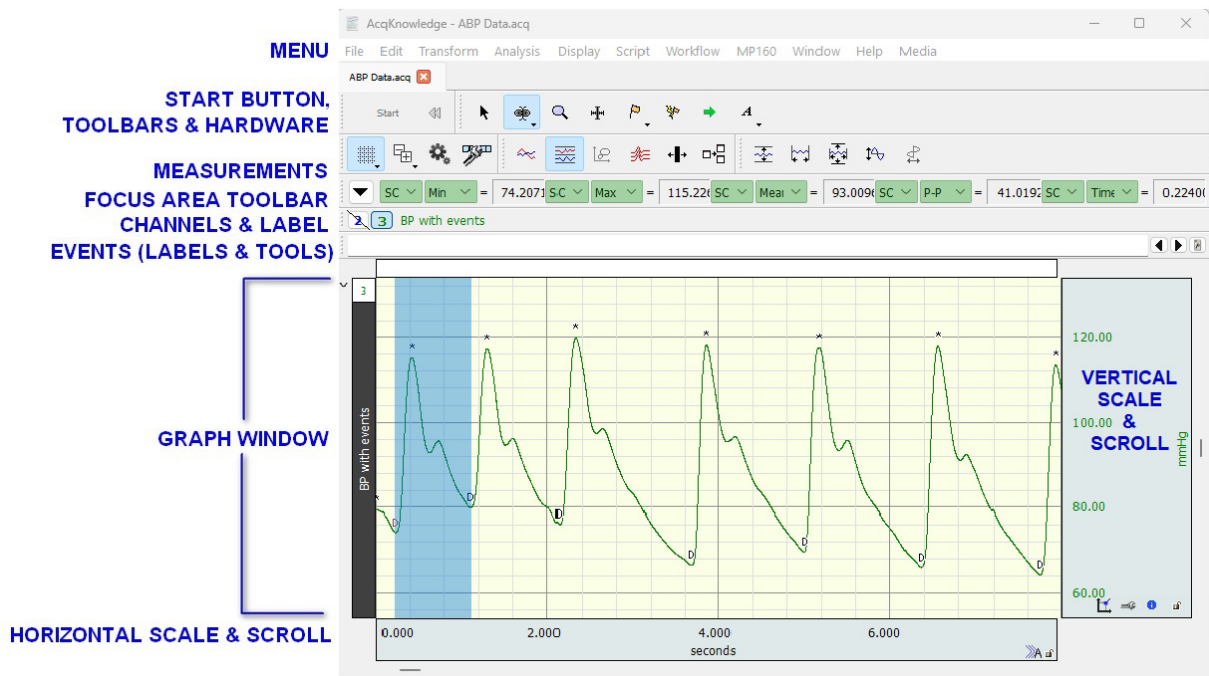
AcqKnowledge® software can be used with multiple MP160 (or earlier-version MP150) data acquisition units to:

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

Efficient Collection

The MP System has several advantages over other recording systems. AcqKnowledge is extremely flexible, allowing full control over how data is collected. Analyze data either while it is being acquired or following completion of the recording. AcqKnowledge will extract 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. The full version of AcqKnowledge includes over 40 **Quick Start graph templates**, which include all the settings for a variety of experimental protocols (explained further in our [RESEARCH CATALOG](#)).

Easy Viewing



AcqKnowledge software is designed to provide a clear interface for working with data and displaying information. AcqKnowledge includes...

- Acquisition Options — variable sample rates, pause mode, multiple data views, and stimulation design and control
- Display Options — advanced grid system, journal facility for note taking, embedded pdf documents for instruction, textual event markers, and measurement tools
- Analysis Options — online signal averaging, ensemble averaging, epoch analysis, AR time-frequency analysis, principal and independent component analysis, autoregressive and nonlinear modeling, automated analysis routines, filtering, FFT, PSD, Histogram, automatic data reduction, template analysis, peak detection features, find rate settings, and an equation generator
- Transform Options — digital filters, Fourier linear combiners, math functions, template functions, integral, derivative, finite difference, integrate, smoothing, difference, resample waveform, resample graph, expression, delay, rescale, waveform math, slew rate limiter
- User-Interface Options — tool tip mouse-overs (for sample rate, channel rate, measurement results, etc.) and real-time, custom presets, change log, searchable MP System guides (PDF format), as well as extensive online support and training documents

With AcqKnowledge, you can perform complex data acquisition, triggering, and analyses using simple pull-down menus and dialogs—no need to learn a programming language or new protocol.

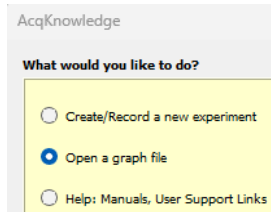
AcqKnowledge software includes fully automated analysis routines for most physiological signals! For ECG data, utilize the automated HRV analysis or locate and mark ECG complex boundaries for both human and animal signals. Take advantage of multiple routines available for EEG, EDA, EMG, and Respiration. Look at RSA or perform a detailed ICG analysis with a few clicks of the mouse. Use AcqKnowledge to save time and standardize analysis protocols.

Let's begin...

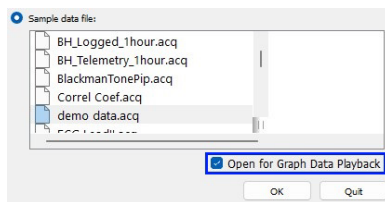
The following steps will walk you through the basic features of AcqKnowledge software. This tutorial assumes the Demo has been downloaded and successfully installed on your computer.

To view an example of AcqKnowledge data display in a simulated recording:

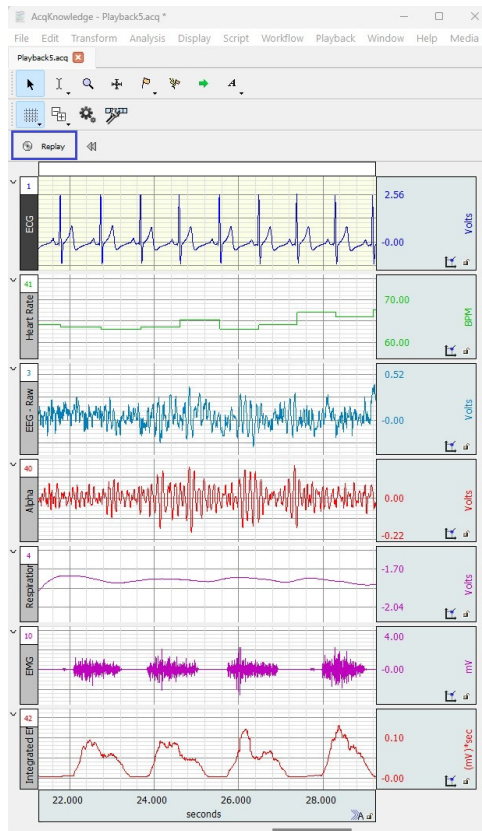
1. Launch the Demo software by clicking the “AcqKnowledge 5.0 Demo” Desktop shortcut.
2. The AcqKnowledge “Startup Wizard” will appear, offering various program options. The default option is **Open a graph file**. Make sure this option is selected.



3. The **Sample data file** option in the lower portion of the screen will be selected by default.
4. Highlight **demo data.acq** from the **Sample data file** list (you may have to scroll down).
5. Check **Open for Graph Data Playback** and click **OK**. The selected file will open in the AcqKnowledge application as a new graph window.



6. Click the **Replay** button in the AcqKnowledge graph window to start the simulated recording.






Pre-recorded data will begin scrolling across the graph window. This is a real-time display of a physiological recording acquired from an adult male subject. Note that each acquired signal appears in its own track, or “channel.” This default channel view is called “Chart Mode.”

Data will be “collected” for 30 seconds and stop automatically, but the replay can be interrupted at any time by clicking the **Stop** button. (The **Replay** button toggles to a **Stop** button while replay is in progress.)

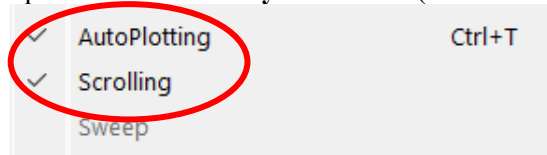
After completing (or stopping) the playback, click **Replay** again to repeat the simulated recording. (Click **Yes** if prompted to overwrite the existing data.) The replay will be identical in appearance and length to the previous data display.

Basic Viewing Tools:

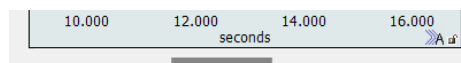
- Click the **Grid** icon  to toggle the grid display on or off.
- Use the **Zoom** tool  to enlarge an area of data (see page 8).
- Use the **I-beam** tool  to select an area of data (see page 8).
- Use the Data Acquisition Setup window to modify the duration and recording mode of the replay (choose **Playback menu > Set Up Data Acquisition > Length/Rate**). The duration can be increased or decreased, and the acquisition modes changed. (See page 5 for further details about acquisition setup.)

During data playback, note that when the data plot reaches the right edge of the window, the waveforms begin continuously scrolling from right to left. For long recordings, it's often 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 under the **Playback** menu (uncheck the boxes).



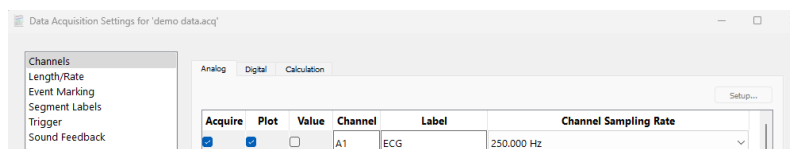
Replay the acquisition again. Now, when the data plot reaches the right limit, the screen will not be redrawn. The horizontal scroll bar will shift position to indicate that the file length is longer than the visible display.



At this point, you can use the **horizontal scroll bar** (example above) to look back through the data. Note the scroll bar position indicator changing while data collection is in progress. This indicates the record is getting longer as new data is being acquired. Reselect **AutoPlotting** and **Scrolling** to again view the new data as it is acquired in real time.

During long recordings, you may wish to accomplish other tasks on the computer. By minimizing or resizing the application window, AcqKnowledge can be busy collecting data in the background while you're using another program.

In addition to the ability to collect data in the background, AcqKnowledge also allows complete control over the channel parameters. To illustrate this, choose **Set Up Data Acquisition > Channels** from the **Playback** menu.





To the left of the **Channel** column, the **Acquire** checkbox enables acquisition, and the **Plot** checkbox enables onscreen plotting. If **Acquire** is on but **Plot** is off, data from that channel will be recorded, but will not appear onscreen.

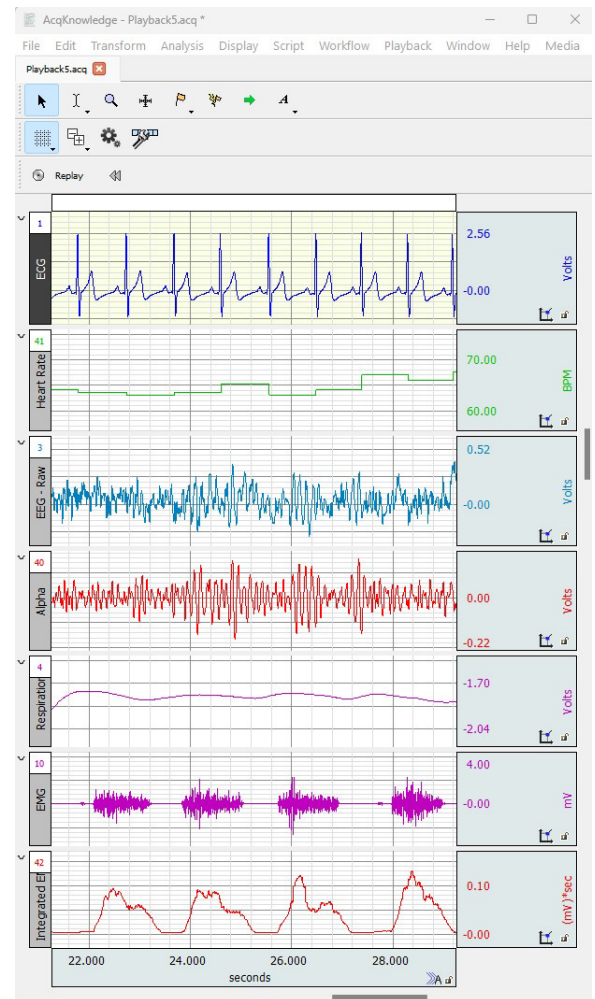
The **Values** checkbox enables the channel's current numeric value to be displayed in an onscreen **Input Values** bar graph (see following page). The **Setup** button on the upper right of the screen is used for setting up parameters in the selected channel, but note that in the Demo's Playback mode, this button is disabled for Analog channels.

Each channel label, or title can be edited as desired under the **Label** column.

The **Channel Sampling Rate** option can be used to downsample individual channels to various sampling rates. Modified Channel Sampling Rate are supported in Playback mode for demonstration purposes.

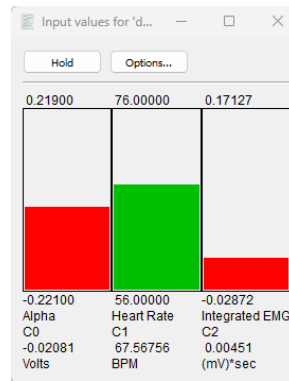
Calculation Channel **Preset**s offer an easy way to apply filters, expressions or transformations in real time and display the calculated data as separate graph channels. To do this:

Click the **Calculation** tab to activate the **Preset**  menu. Click the  (arrow icon) to generate a list of preset options. Use an existing preset or modify it to create a new one. Note that Calculation Presets only work in conjunction with Analog input presets, or with other calculation channels coupled to an Analog source channel.



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

Click the **Options** button in the Input Values dialog to generate controls for changing the size, precision, and format of the Input Values display.



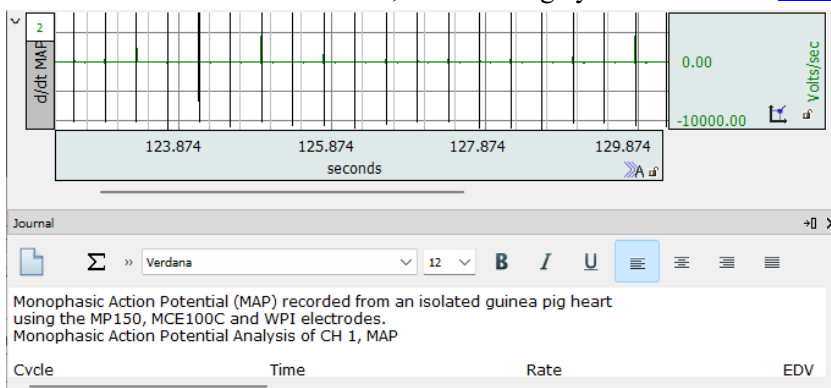
To further control the acquisition, select **Set Up Data Acquisition > Length/Rate** from the Playback menu. This is where all data recording parameters are set, or in the case of the Demo, data playback parameters. The basic options are **Sample rate** and **Acquisition Length**.

- **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. However, this option is disabled in 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 can be set to samples, msec, seconds, minutes, or hours by clicking the pop-up menu to the right of the **Acquisition Length** value.
- **Repeat every** is used to set up single or multiple consecutive acquisitions at a user-defined time interval.


Restarting the acquisition with the **Replay** button will apply any modified settings, although as previously stated, the Demo is locked to an acquisition sample rate of 1000 samples/second. Parameters can also be set to store data to **Memory**, **Disk**, or **MP160 unit**. For more sophisticated acquisitions, **Averaging** mode can be applied. (Note that the Demo version does not support the use of MP160 unit or Averaging acquisition modes.)

Using the Graph Journal

The Journal is a text editor built into AcqKnowledge for recording notes and data and saving text and/or numeric values for later review. Journals can be used at the same time data is being acquired, and can be docked at the edge of a graph or free floating. To enable the Journal, go to “Display > Show > Journal” or use the Display toolbar button and select “Journal.” To paste data to the Journal, go to “Edit > Journal” and use any of the paste options. For in-depth details on how to use the Journal, we encourage you to watch the [Tutorial Video](#).




Using the Channel Buttons to Select or Hide Channels

In the upper portion of the acquisition window, a row of small buttons indicates the acquired channels. (Channel buttons can be enabled via the **Display** toolbar button  or **Display** menu > Show > Channel Buttons.)




The leftmost box corresponds to the waveform at the top of the screen. The box appearing outlined and shaded is the selected (or “active”) channel. Only one channel can be selected at a time. The color of each channel’s waveform and indicator box correspond to those in the graph channels 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 or channel button with the arrow  tool.

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.

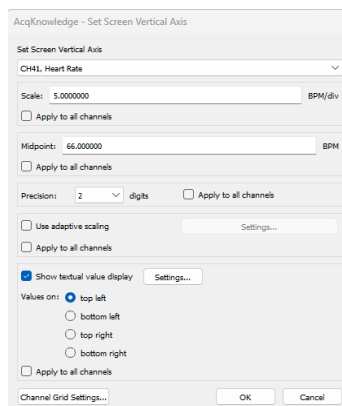
Temporarily hide channels by clicking a channel’s indicator box while holding down the **Alt** (PC) or **Option** (Mac) key. The hidden channel’s box will be marked with a slash, and the display redrawn minus this channel. Repeating this keystroke on a hidden channel restores the view. Multiple channels can be hidden at a time.



Channels can also be collapsed from view by clicking the “v” button in the upper left of the channel label  and restored by clicking the resulting “>” button.

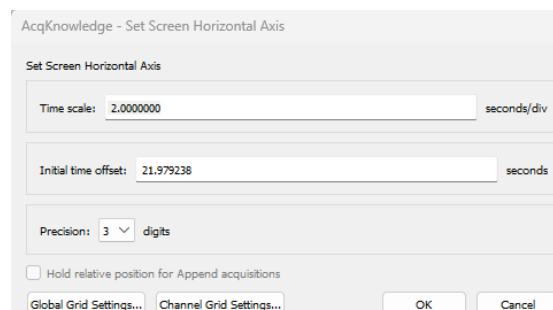
Adjusting Vertical and Horizontal Scales in a Channel

To adjust the vertical scale of the selected channel, click the vertical scale region to the right of the channel. The Set Screen Vertical axis 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 within 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. (See “Set Screen Horizontal Axis” figure below)



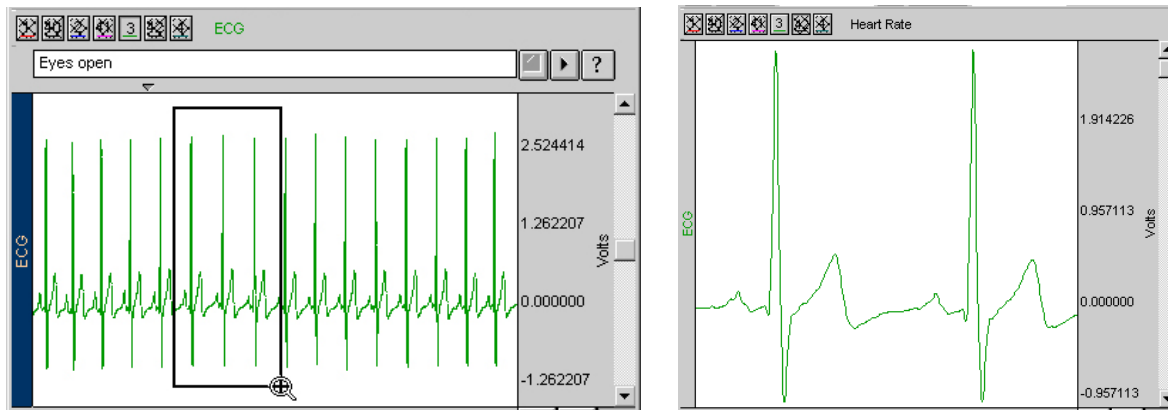
Using the Zoom Tool



To enlarge an area of interest, use the zoom tool in the cursor toolbar.



Click the zoom tool, then click and drag the mouse to form a box over the desired area. Now, release the mouse button and you will instantly see the enlarged area (example below).



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

Selecting Data with the I-Beam Tool and Using Measurements

- 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...
- Sum
- Rate_mean
- Rate_median
- Rate_stddev

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

The sample data window shown at right has two measurement popup menus set to **Delta T** and **BPM**.

In this example, the interval between two peaks is selected. Using the **Delta T** measurement, the two peaks occur **0.807 seconds** apart, which results in a **BPM of 74.349** as indicated the BPM measurement box.

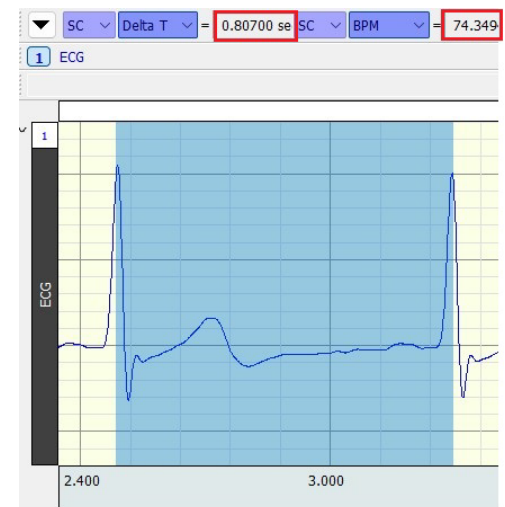
To access any of over 30 measurement functions, click the popup menu next to the measured value and select the new measurement. To change the channel a measurement is based on, choose from the **SC** popup menu. By default, measurements are taken from the selected channel (as indicated by **SC**).

The values will change while the I-Beam tool is being dragged across 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, see page 13) will identify specific events based on a variety of thresholds or allow you to enter a time period. In the time period mode, the software will take the selected measurement at the defined interval.

The I-Beam 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.



Data Display Modes

AcqKnowledge offers several display options, including **X/Y plotting**. You can switch display modes by using the toolbar icons in the upper left-hand corner of the window.

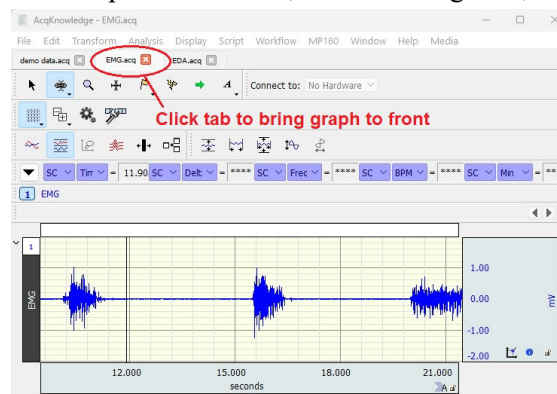


Scope, Chart, X/Y, and Overlap display mode icons

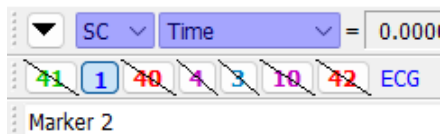
By clicking these icons, your display can alternately emulate a chart recorder or oscilloscope, or you can plot data from one channel against data from another channel. You can also overlap appended data segments to simplify comparison (requires acquisition setup for append). X/Y plots are useful for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



AcqKnowledge supports the display of several files onscreen at one time. Simply choose **File > Open** and make your selection. Graph windows can be displayed as windowed or tabbed, and moved and resized to ease in viewing. Clicking 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.

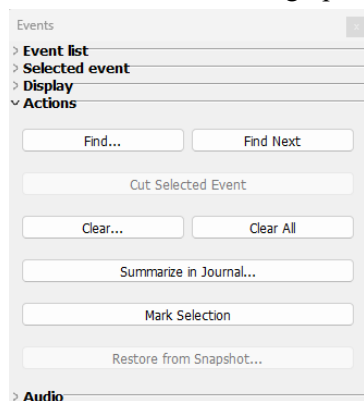
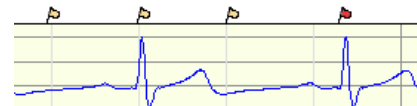



Event Marking System



For some experiments, it's very useful to mark when an event occurs. To do this, use the on-screen event marking 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 "Zap" toolbar button  and click 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 add a global event during acquisition (or Playback mode,) press the **Esc** key while the recording is in progress. The figure at right depicts global event markers inserted into a graph while recording.



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 .

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.


See the [AcqKnowledge Manual](#) under the **Help** menu for Event setup, control, and measurement options, including Hotkey setup and automated detection. You are also encouraged to watch the online [Event Marking Tutorial Video](#).

Read "User Interface & Context Menu Features" in the complete [AcqKnowledge Manual](#) available under the Help menu for more tips!

Focus Areas

Focus Areas allow you to define selected areas of data and permanently save them in the graph for discrete analysis. An unlimited number of Focus Areas can be defined, and then easily navigated with the “Focus on” toolbar buttons. This feature is useful for highlighting and locating noted areas in a larger data set without having to manually scroll through the data.

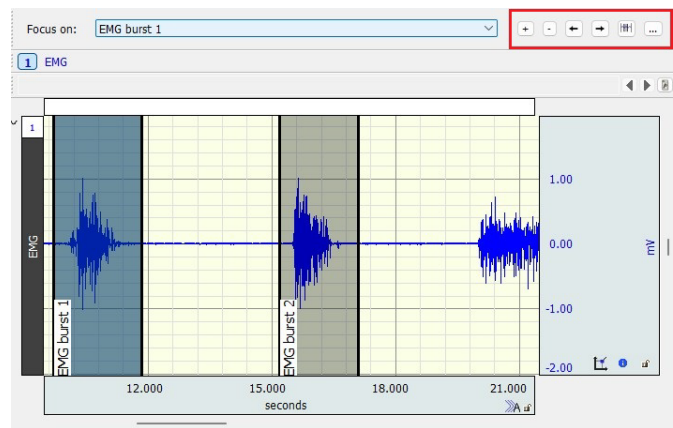
To define and navigate to a Focus Area:

1. Go to “Display > Show” and enable “Focus Areas Bar” and “Focus Area.”
2. Using the I-Beam tool,  select an area of data.
3. Right click inside the selected data and choose “Create Focus Area”
4. Enter a name for the Focus Area in the label dialog and click OK.

Unlimited Focus Areas may be created within a graph. Use the “Focus on” toolbar arrow tools (outlined in red in the figure on right) to navigate quickly through Focus Areas.

For further details about the Focus Area tools, see the *AcqKnowledge* Software Guide or the online [Focus Area Tutorial](#).

We also encourage you to explore the above tutorial steps using any of the 50-plus sample data files included in the Demo software. These files can be opened in Playback or Analysis mode in the Startup Wizard as shown on page 3.



Powerful Analysis

In *AcqKnowledge*, all acquisition settings, scalings, Journal content, preferences, etc., are saved with the data when **File > Save** is chosen. Note that modified data and parameters cannot be saved in the *AcqKnowledge* Demo version.

The File > Save formats shown on right and explained below are supported in the full version of *AcqKnowledge* only. They are included here for illustration purposes.

- **Graph (.ACQ)** saves data in a binary file format that uses minimal disk space.
- Use the powerful **Graph Template (.GTL)** feature to 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. Sample **Quick Start** files are 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 “MAT-file” 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.

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.

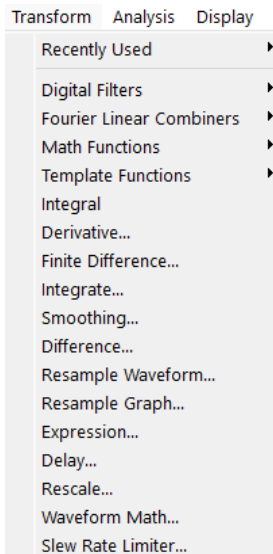
View video tutorials and software overviews **online** at www.biopac.com/videos.

Graph (*.acq)
 Graph Template (*.gtl)
 Text (*.txt *.csv)
 Windows AcqKnowledge 3 Graph (*.acq)
 PhysioNet - WFDB
 MATLAB Mat-File (*.mat)
 Raw
 Igor Pro Experiment (*.pxp)
 WAV (*.wav)
 EDF (*.edf *.eeg)
 JPEG (*.jpeg)
 Compressed Graph (*.acq)
 Excel Spreadsheet (*.xls)

Help Media

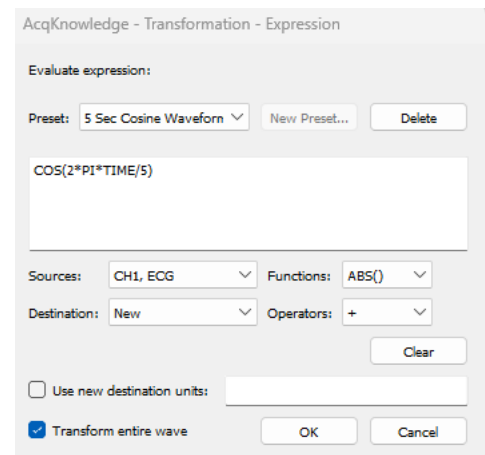
Tutorial Screencasts from Web
 Application Notes from Web
 Open AcqKnowledge Manual
 Open MP Hardware Guide
 Open BioNomadix Smart Center Guide
 Open BioNomadix Logger User Guide
 Open AcqKnowledge Demo Guide
 Open BIOPAC Basic Reference
 About AcqKnowledge...

Transforming Data

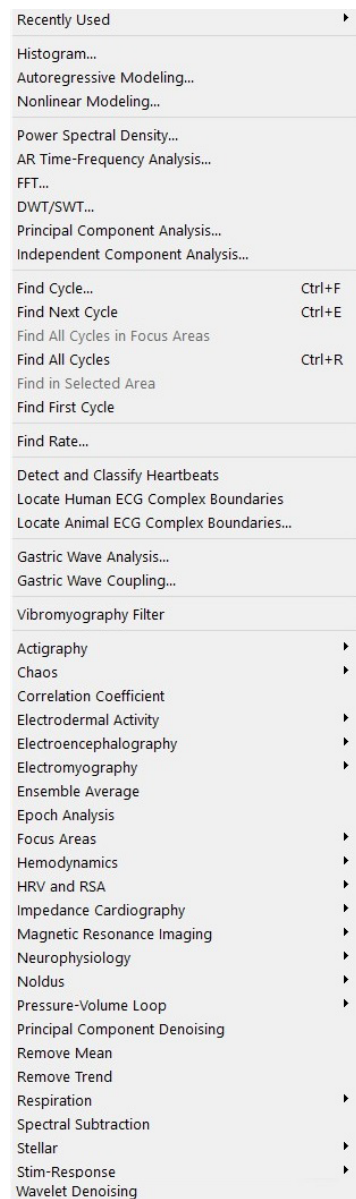


The **Transform** menu contains operations that modify the data in the graph after the recording is completed and opened for analysis.

- **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.
- **Finite Difference** applies an algorithm that performs numerical approximation of higher order derivatives.
- **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.

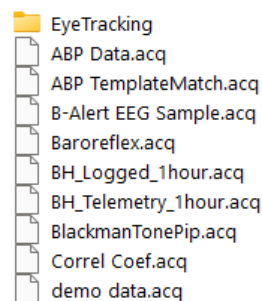


Analysis Menu



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

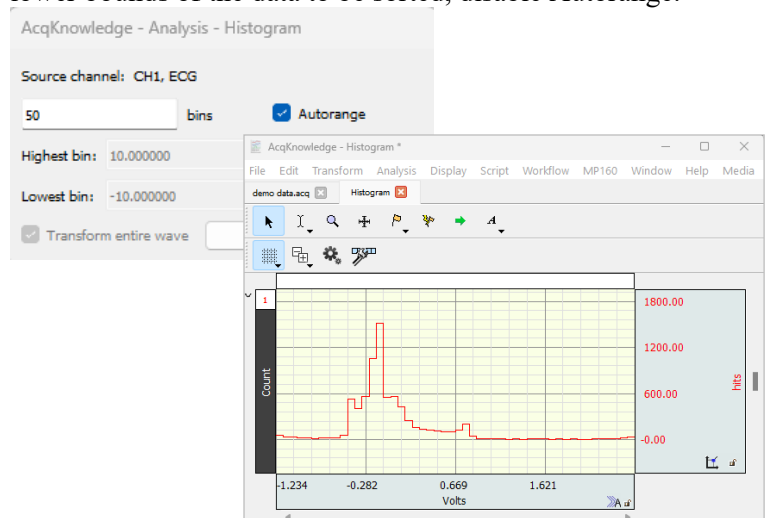
Use over 50 **Sample Data** files to further explore the power and flexibility of *AcqKnowledge* software, including the analysis automation tools.



The **Analysis** menu contains many operations that derive data and measurements from the graph. The following brief examples are presented:

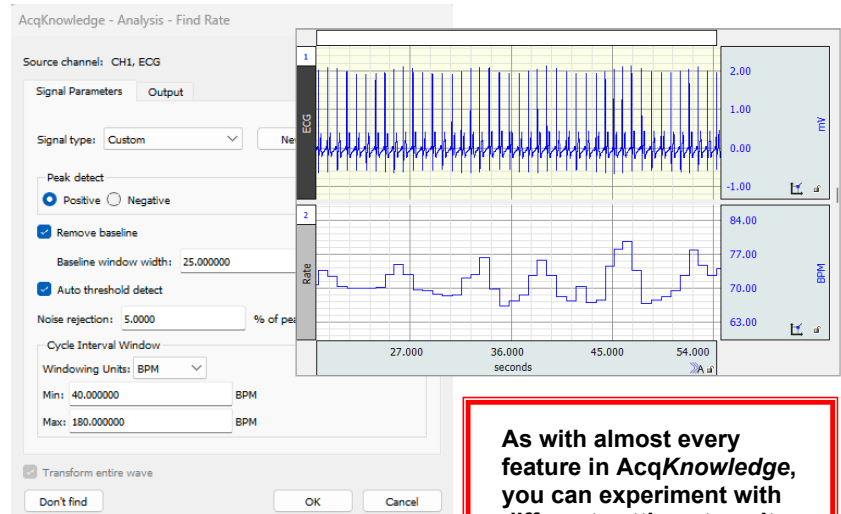
- **Histogram** allows you to display data in summary format and examine the central tendency characteristics and variability within a waveform.

- 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 cycles 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.

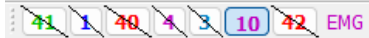


As with almost every feature in *AcqKnowledge*, you can experiment with different settings to suit your needs.

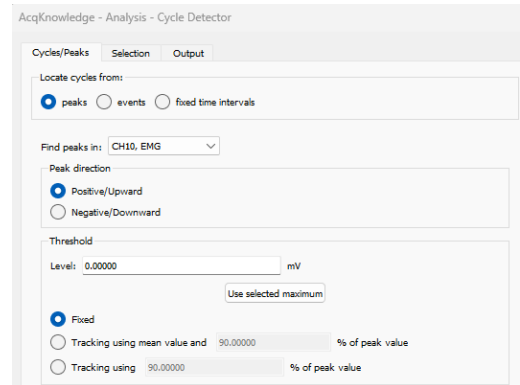
Find Cycle/Peak Analysis:

The advanced Cycle/Peak Detector combines with the powerful new Event Marking System. Use it to perform amplitude, time, or event-based measurements. The following is a guided example of the Find Cycle tools.

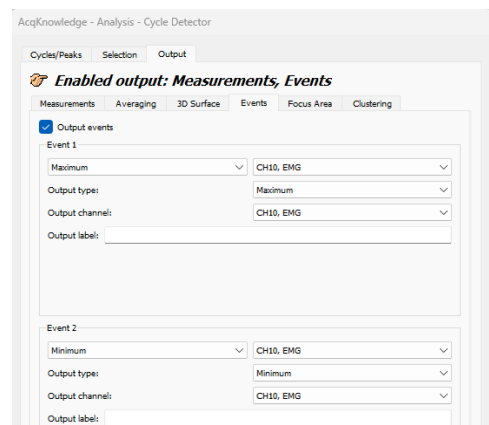
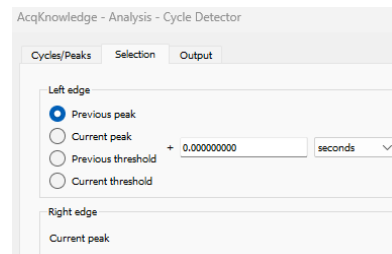
1. Hide all channels in the “demo data” file except CH 10 EMG.



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.

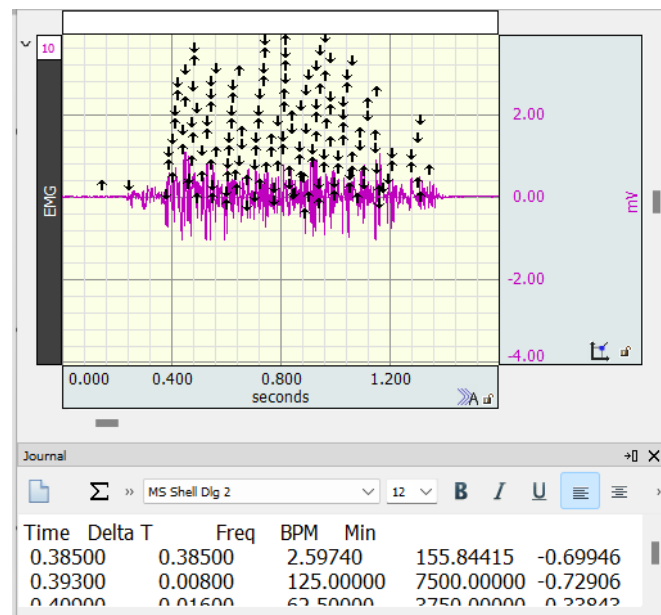


7. Click **Find All Cycles**.
 - Click **YES** if prompted to proceed with Measurement Scaling Enabled. If prompted regarding cursor position, click **Set to Origin**. Click **Yes** if prompted to create a Journal.
8. Scroll left to the start of the data file.
9. Use the Zoom tool to examine event definition and placement.
10. Click or display Journal to review pasted event text.

[Click here](#) to watch a Find Cycle demo.

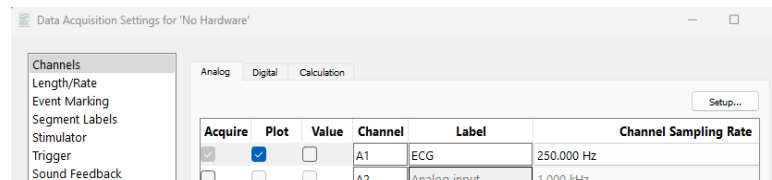
See the Find Cycle tutorial sample data files in the Startup Wizard “Sample Data File” menu.)

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



Exploring AcqKnowledge “View by Modules” Setup

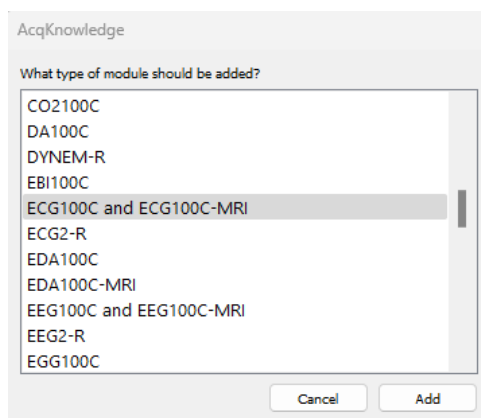
The default channel setup option in the AcqKnowledge Demo is [View by Channels...](#). In this display, three columns of boxes appear next to text boxes describing the channel, label and sample rate information. All channel setups in this mode are performed manually.



For users of MP160 hardware, AcqKnowledge features a “View by Modules” setup option. In this mode, guided prompts assist in adding modules/transducers and establishing necessary hardware and channel 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. Module Setup mode is presented by default in the full version of AcqKnowledge. This can greatly assist in expediting proper setup of the connected BIOPAC equipment.

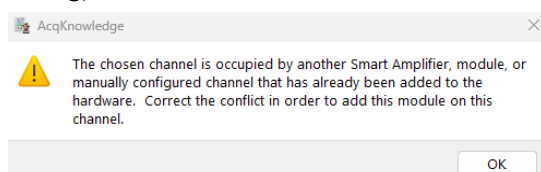
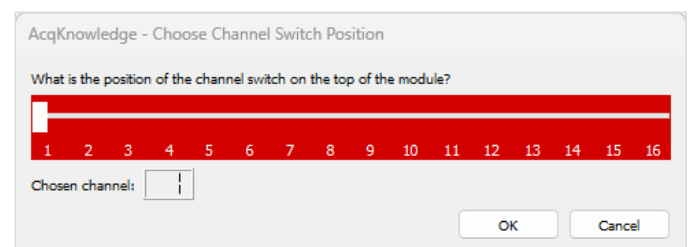
To explore “View by Modules” setup in the Demo version:

1. Open the Demo Data file while selecting “Open for Graph Data Playback.” Exit Playback Mode by choosing the menu “Playback > Exit Playback Mode.” The “Playback” menu item will show a simulated MP160 menu.
2. Choose MP160 > Set Up Data Acquisition > Channels and click the [View by Modules...](#) button.
3. Click the [Add New Module...](#) button and select a module from the list and click Add. (The ECG100C module selected below is for example purposes only. The AcqKnowledge Demo does not support the use of actual hardware or transducers.)

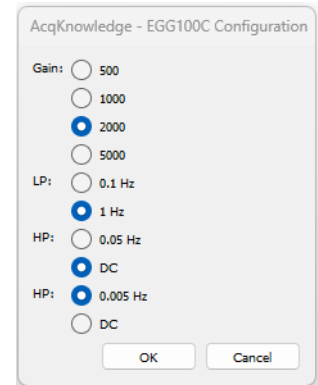
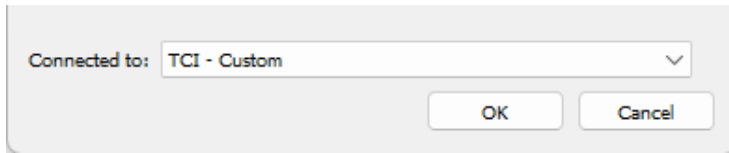


For video overviews on setting up channels for wired, wireless, and specialty amplifiers, visit our [Hardware Tutorial](#) page.

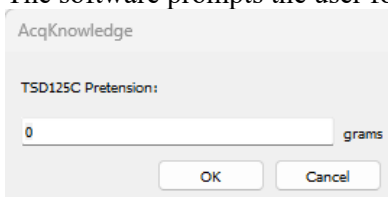
4. If prompted, input the channel switch settings from the selected module.
In actual practice, the “Choose Channel Switch Position” would match the switch number selected on the BIOPAC module. Setup detects any potential channel conflicts between software assignment and the module’s red channel switch position (see below warning dialog).



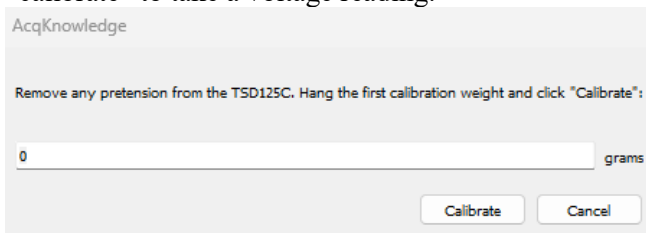
5. Establish the configuration for gain and filters as shown on right and click **OK**. In practice it is important to set the Gain and Filter settings to match the switch settings on the amplifier. The software uses this information to scale the signal to the correct units. If the Gain is not set to match, the signal will be scaled incorrectly.
6. If prompted, select a transducer and click **OK**.



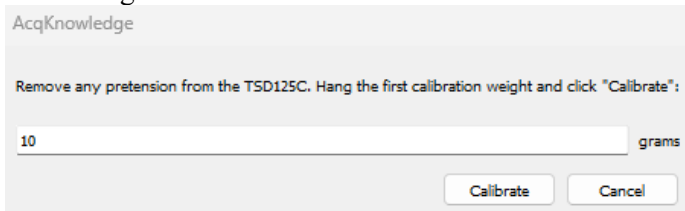
7. Perform calibration steps, if required. The software will automatically scale certain signals if they only require a zero setting. However, some signals require a two-point calibration. In this case, the software will generate additional prompts for the scale values. The following example shows the dialogs for setting up a TSD125 series force transducer.
 - a. The software prompts the user for pretension amount; enter “0” if pretension is not required.



- b. Enter a low calibration value or “0” 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.

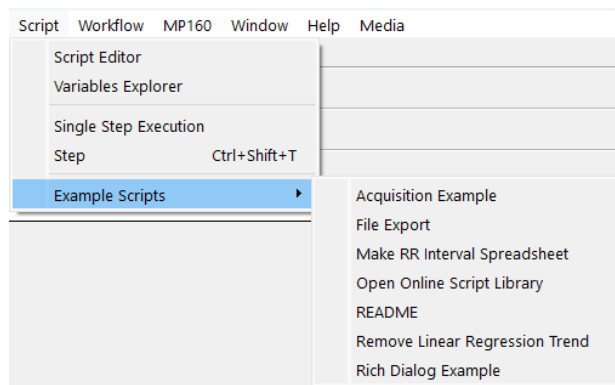


Note: When recording is started, the data may show an offset. This offset is the amount that was entered in the pretension dialog. Adjust the tension applied to the transducer to center the signal on zero.

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.

Scripting

BIOPAC Basic Scripting is a scripting language development option for *AcqKnowledge* that allows for viewing of runtime variables, creating new script files and editing existing script files, triggering of individual script functions for testing and single step functionalities. This functionality is available via an optional license. To explore scripting, access the *AcqKnowledge* Demo's Script menu and run some of the examples.

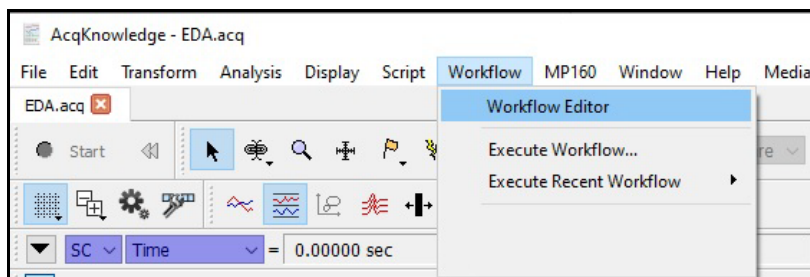


For further information about BIOPAC Basic Scripting, you are encouraged to read the Script Menu README or the Biopac Basic Reference in the Help menu.

Workflow

AcqKnowledge Workflow is a licensed feature that allows users to create automated analysis routines or macros without any prior scripting knowledge. Workflow uses a simple and intuitive drag-and-drop interface to string together a series of Actions. This feature requires *AcqKnowledge* 5.0.8 or later.

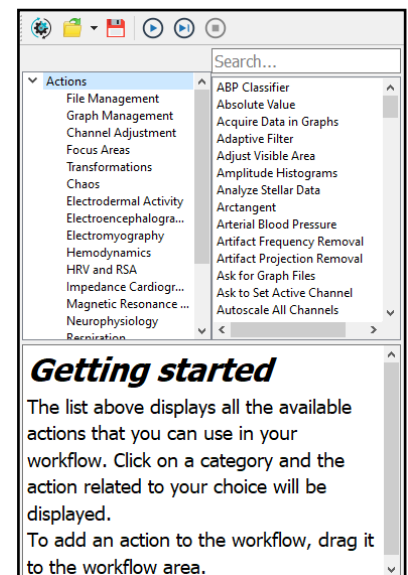
1. To create a new Workflow, choose the menu item Workflow > Workflow Editor from the menu bar in any graph file. Note that the **Transform** and **Analysis** tabs are greyed out and unavailable when in Workflow Editor.



2. Three windows will be displayed on the left side of the screen. The upper left window lists Actions Categories under the heading **Actions**. Clicking the **Actions** heading will display a comprehensive list of possible Actions that can be performed in the window to the immediate right (beneath the **Search** window). Clicking a category filters the Actions in that category, and only those filtered Actions appear in the right window. Actions can also be located by entering key words into the **Search** window.

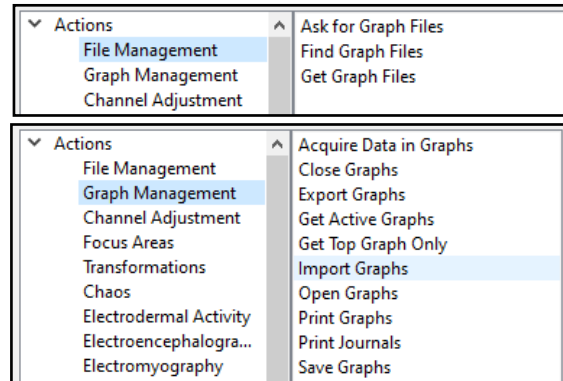
The information window in the bottom left side of the Editor screen displays a description of what each Action does. If no specific Action is selected, it will display the "Getting started" dialog. This dialog provides basic instructions on how to select Actions and add them to your Workflow.

3. Six control icons are located on the tool bar above the Action windows. The Actions these icon buttons control are (from left to right) **New Workflow**, **Open Workflow**, **Save Workflow**, **Run Workflow**, **Run Workflow Step by Step**, and **Stop Workflow**.



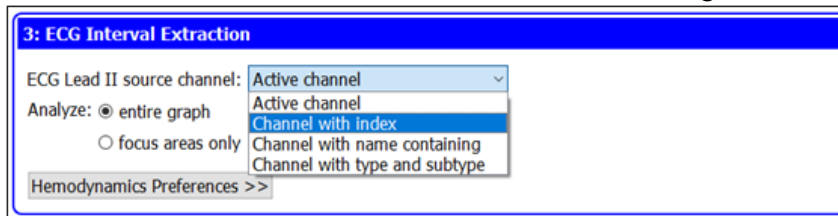
Creating a New Workflow by Adding Graphs

1. Workflows operate on graph windows selected via the **Graph Management** Actions category. Graph windows may be opened either through the user interface (e.g., via “File > Open...”) or via **File Management** Actions.
2. Select a graph or graphs via Actions in the **Graph Management** category. If no such Actions are selected, the Workflow will not perform any useful function. Drag and drop the Action into the **Workflow** window.



Selecting and Adding Actions to Workflow

1. Once one or more graphs have been added to the Workflow, additional Actions can be added by simply dragging and dropping them into the **Workflow** window.
2. Once an Action has been dropped into the Workflow window, it will be displayed as a numbered step in the Workflow. After an Action has been added to the Workflow, it cannot be dragged to a new position. If a user wishes to change the order of Actions or remove the Action from the Workflow, click the “x” in the upper right corner of the Action in the Workflow window to delete the Action. Actions can then be readded to the Workflow in the desired location or a new Action can also be added to any position in the Workflow order.
3. Many Actions have options and variables for the user to select and/or define, which are displayed once the Action has been dropped into the Workflow window. These user-defined options may be shown as pull-down menus, check boxes or buttons, or text windows for entering numerical values.



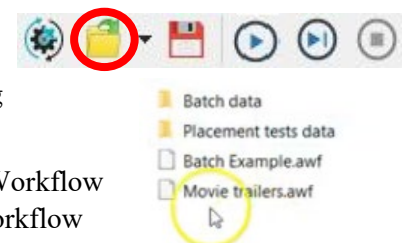
As an example, the above image shows the **ECG Interval Extraction** Action with options shown in both pulldown menus and buttons, as well as a **Hemodynamics Preferences** tab (closed), which when opened allows the user to select an additional range of options.

4. Once Actions have been added to a Workflow and options have been selected for those that require them, the completed Workflow can be saved by clicking the **Save** icon and naming the Workflow file, which will be saved with the .awf file extension.



Running a Workflow in AcqKnowledge

1. Once a Workflow has been saved it can be run in conjunction with an AcqKnowledge .acq file. Begin by opening the associated .acq file (in AcqKnowledge 5.0.8 or later) with which you would like to run an existing Workflow.
2. With the AcqKnowledge file open, select the Workflow tab and open the Workflow Editor. With Workflow Editor open, select the Open File icon from the Workflow toolbar and navigate to the AcqKnowledge Workflow file (.awf) you wish to open.
3. Once the Workflow is open, the list of Actions will be displayed in the Workflow window.
4. Make sure the Workflow contains the Actions to select the correct graph or graphs from the Graph Management category (see Creating a New Workflow by Adding Graphs).



5. To execute the Workflow, simply click the **Run Workflow** icon from the toolbar.
6. Optionally, users can run the Workflow so that it pauses after each step. To do this, click the **Run Workflow Step by Step** icon and continue clicking it to progress the Workflow through each Action. Click the **Stop Workflow** if you need to halt the Workflow's progress mid-run.
7. The Workflow will stop automatically once all Actions have been completed.



For additional information on Workflow, please see our [short video tutorial](#) and [in-depth webinar](#) on this feature, as well as the [Workflow license product page](#).

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. For on-demand training sessions such as [AcqKnowledge Bootcamp](#) see our [Webinars Page](#).