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USER REFERENCE GUIDE
ACQUISITION & ANALYSIS SOFTWARE

Manual



BIO LAB

Safety

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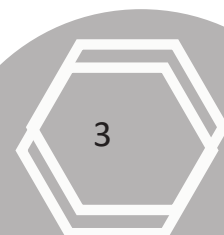


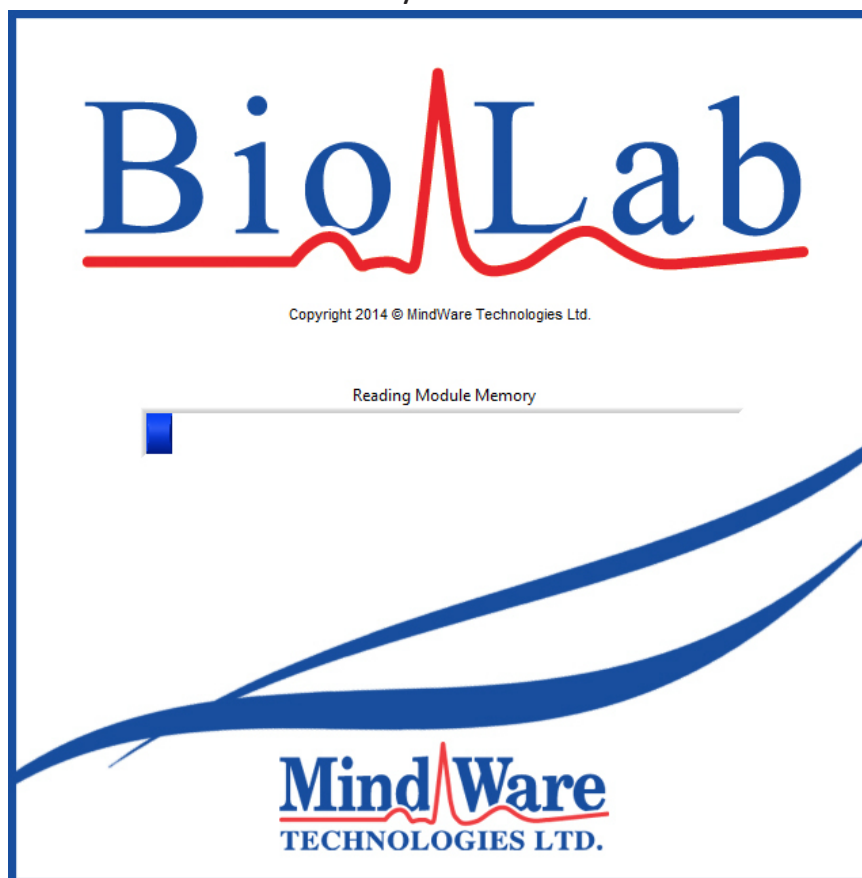
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Section 1

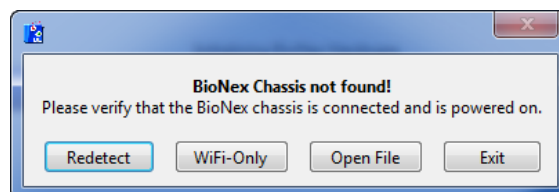
Startup

Upon starting the MindWare BioLab software, the following screen will appear as the application the hardware detected in the system.



In the event that no hardware is detected, the option is given to:

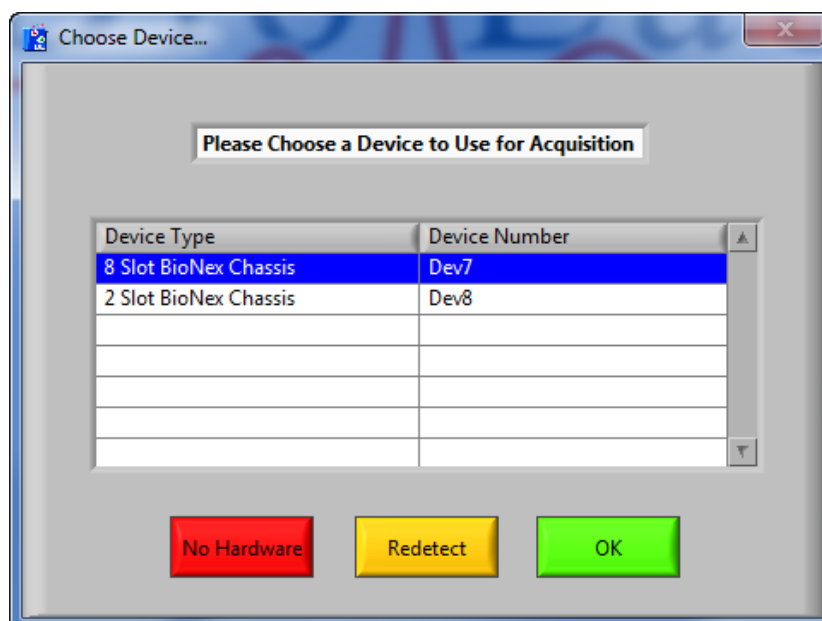
- Attempt to detect the hardware again
- Collect using WiFi devices only
- Open a file
- Exit the application



Once the connected hardware is properly initialized (or user has chosen to proceed without hardware), the configuration screen is displayed. If the detected hardware contains no modules in it, a warning will be displayed.

Section 1

In the event that more than one device is detected in the system, the following prompt will appear allowing the user to specify which device to use in acquisition:



No Hardware: This button proceeds to the BioLab Configuration screen without selecting any device listed for use in acquisition.

Redetect: This button will redetect new devices connected to the system since this window has opened and update the list of devices accordingly.

OK: This button chooses the selected device for acquisition.

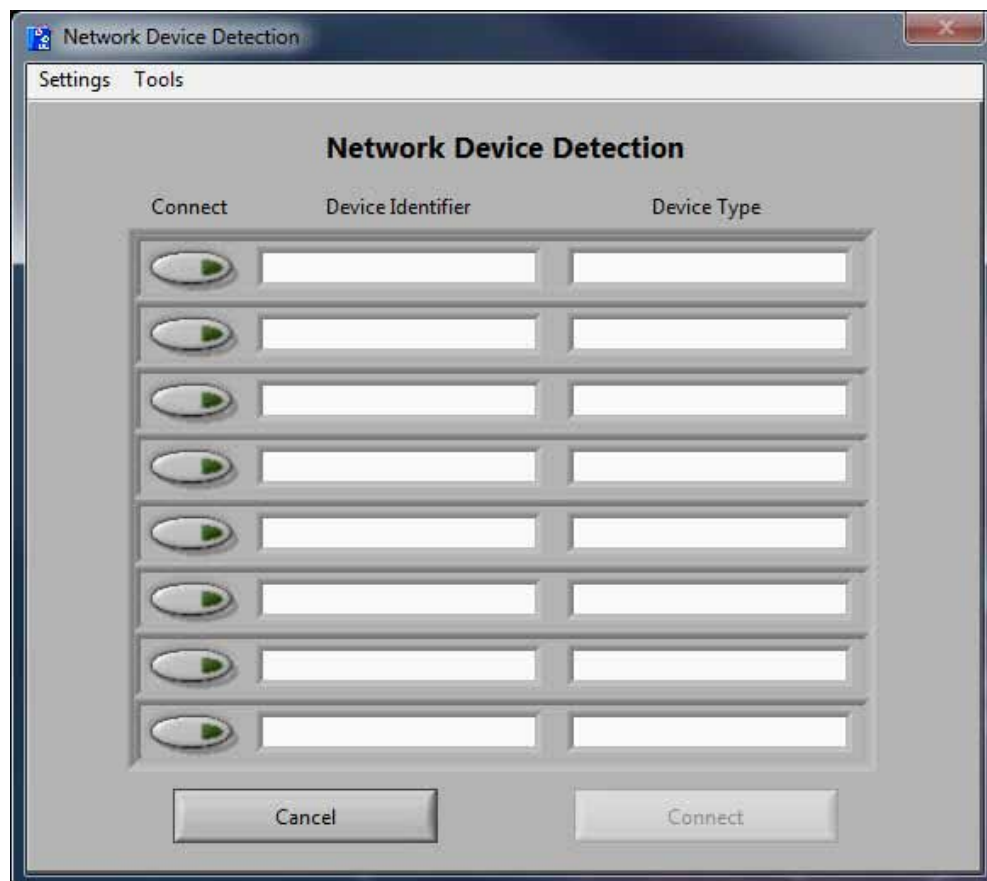
After a device has been chosen the first time, it will become the default device for acquisition. This screen will no longer appear at the start of BioLab once this is done. To use a different device for acquisition in the future, choose **Redetect Devices** from the menu bar on the BioLab Configuration screen (see **Section 2: BioLab Configuration (Acquisition Mode)**).

Note: Please make sure that your computers language format is set to "English (United States)" to assure proper application functionality.

Section 1

Network Device Detection

If the acquisition source is currently set to Ambulatory Wi-Fi or BioNex & Ambulatory Wi-Fi, the Network Device Detection screen will appear prior to entering the BioLab Configuration screen allowing the user to connect up to 8 network devices for acquisition.



As network devices attempt to connect to the system, they will appear in the table on this window. Up to 8 network devices can be listed simultaneously. The following settings are available from the Settings menu:

Change IP Address: This display allows the user to specify the IP address to use for connection with network devices. If an IP address has not been specified this prompt will appear prior to entering the Network Device Detection screen.

Note: BioLab will need to be restarted for changes to take effect.

Known Device List: This display lists the known network device configurations in the system. Any device which has previously been connected will be listed here and have a known configuration.

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The following options are available from the Tools Menu:

Direct Discovery: Allows for a direct connection to a MW Mobile with a known IP address. This feature is useful for restrictive network environments where the normal connection procedure is not acceptable. Enter the IP address of the MW Mobile to connect to and press OK to attempt a connection. Previously used IP addresses are stored in the drop down list.



The device list contains the following information and settings:

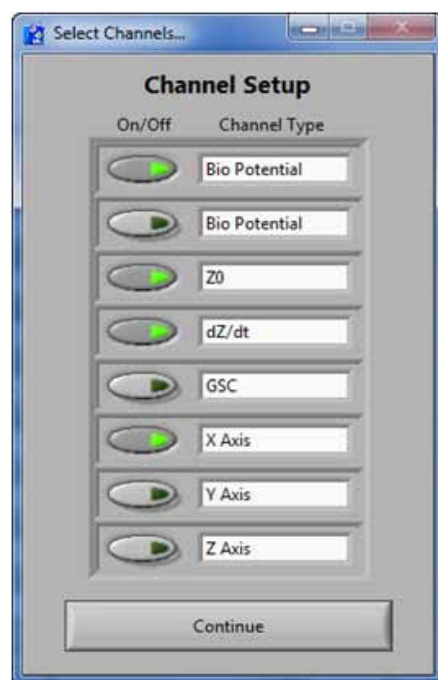
Connect: Activating this control indicates that the specified network device will be connected to the system for acquisition. In Ambulatory Wi-Fi mode, up to 8 units may be connected at the same time. In BioNex & Ambulatory Wi-Fi mode, up to 4 units may be connected at the same time. Attempts to connect more than the allowed number of units will result in an error message.

Device Identifier: Displays the name of the network device.

Device Type: Displays the type of the connected network device.

Section 1

When pressing Connect on any of the network devices in the list, the channel selection screen will appear.



From this screen the user can specify which channels will be used for acquisition. Up to four channels can be selected simultaneously. If any more than 4 channels are selected, a warning will appear and the most recently selected channel will be automatically deselected. When all desired channels have been enabled, press **Continue** to return to the Network Device Detection screen.

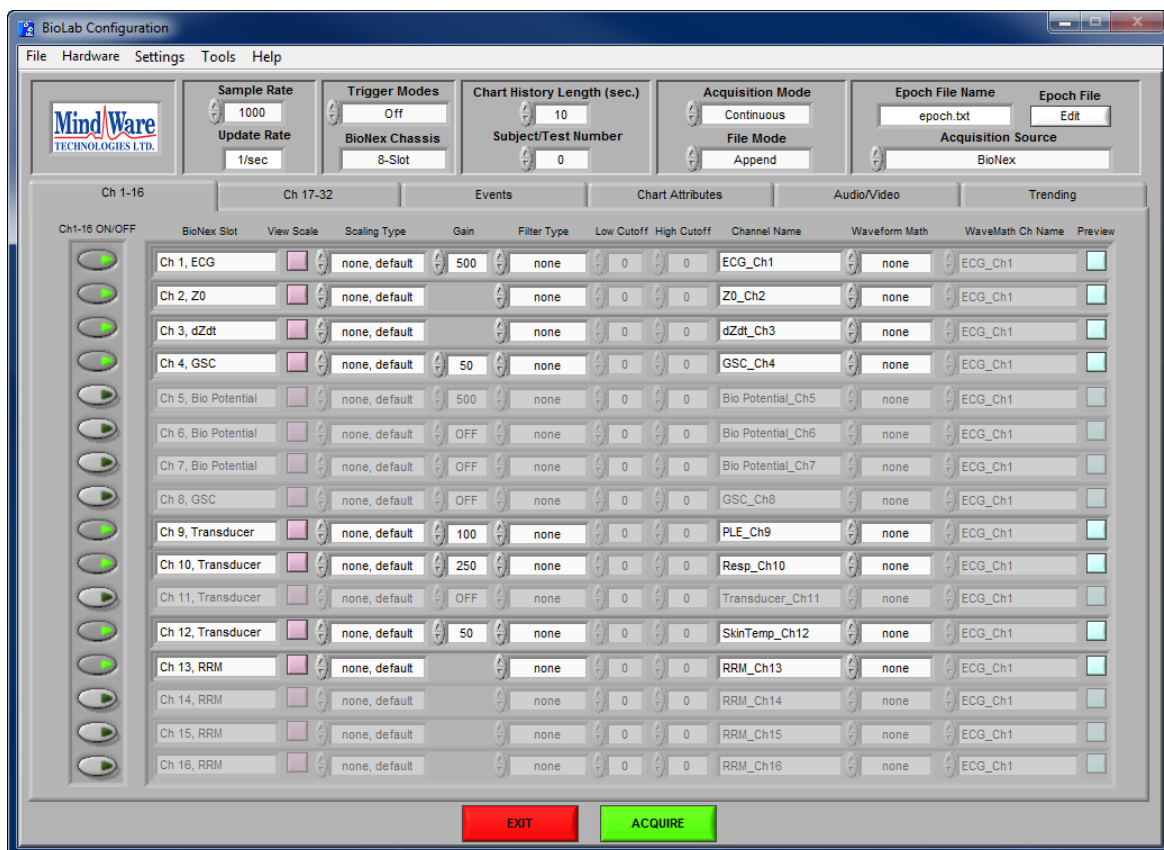
Pressing the **Cancel** button on this screen will proceed to the BioLab Configuration screen without connecting any network devices. Pressing the **Connect** button will establish a connection between all enabled network devices and the host computer, making them available for acquisition.

Note: Connection time may vary based on network speed, network traffic, number of devices, etc. Allow up to a few minutes for connections to be established

Section 2

BioLab Configuration (Acquisition Mode)

The BioLab Configuration screen contains many of the adjustable program settings. Any changes made to the settings within this screen are automatically saved for future sessions whenever acquisition is initiated or the application is exited. The settings have been divided into three sections: Menu Bar Settings, Main Settings, and Sub Menu Settings.



Menu Bar Settings

The following settings are available from the menu bar:

File:

Open File: This option allows the user to open a MindWare file for viewing in the built in file playback mode

Export Events: Export events from an MWI file to a text file.

Section 2

Save MindWare File As: This option allows the user to save the currently opened MindWare file as a new file

Note: This option will be disabled unless a MindWare file has been opened for viewing.

Exit: This option closes the BioLab application.

Hardware:

Redetect Devices: This option restarts the BioLab application, re-initializing all hardware and re-detecting all modules. If a new module or device is connected to the system after BioLab has been started, this option will allow BioLab to detect the new component. If multiple devices are connected to the machine and you would like to select a different device for acquisition, selecting this option will allow you to do so.

Note: If Ambulatory wireless devices are connected, selecting this option will result in disconnecting these devices from the system.

Settings:

Open Configuration: This option allows a previously saved configuration file (.mwcfg) to be opened.

Save Configuration As: This option saves all current settings in the BioLab Configuration screen to a configuration file (.mwcfg) which can later be recalled.

Reinitialize All to Default: This option will return all settings in setup screen to factory default. All configuration files will be renamed to *Configuration File Name_old.cfg* and new files will be created in their place.

Note: All configuration files are stored in the Application Data folder of the user currently logged into the computer.

Tools:

ASCII-MW Converter: The ASCII-MW Converter allows the conversion of any text file containing data in some character-delimited columns to the .mw format so that it may be used in any application (See Appendix A: ASCII-MW Converter).



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Build MWI: Builds an MWI file from an existing MWX file (needed for analysis of MWI files and viewing of data collected locally on a MindWare Mobile).

Help:

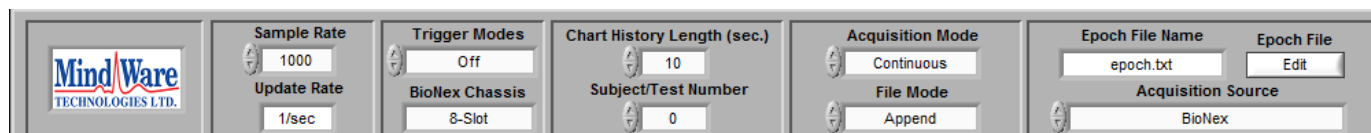
Show Help: This option opens a small window containing descriptions of the controls available on the screen. Hover over the desired control to view its description.


About MindWare: Opens a small window with information about MindWare Technologies and the analysis application

Check for Updates: **This option requires an internet connection** Checks for newer versions of software and drivers. This check will happen automatically unless it has been disabled from the update window.

Section 2

Main Settings



	Sample Rate	Trigger Modes	Chart History Length (sec.)	Acquisition Mode	Epoch File Name	Epoch File
	1000	Off	10	Continuous	epoch.txt	Edit
	Update Rate	BioNex Chassis	Subject/Test Number	File Mode	Acquisition Source	
	1/sec	8-Slot	0	Append	BioNex	

The following main acquisition settings are located across the top of the BioLab Configuration screen:

Sample Rate: This control sets how fast the data is acquired (in samples per second).

This value is fixed at 500 samples per second when acquiring from network devices

Update Rate: This display shows how often the Acquisition screen is updated (in updates per second).

Trigger Modes: This control determines how acquisition is started and stopped. The following trigger modes are available:

Off: In this mode acquisition is started and stopped by manually pressing the Start/Stop button on the Acquisition screen.

Rising: In this mode acquisition is started on a rising edge (low to high) detected on the Trigger In line of the BioNex. It is stopped by manually pressing the Start/Stop button on the Acquisition screen.

Falling: In this mode acquisition is started on a falling edge (high to low) detected on the Trigger In line of the BioNex. It is stopped by manually pressing the Start/Stop button on the Acquisition screen.

Pause Low Level: In this mode acquisition is active when the Trigger In line of the BioNex is high and paused when it is brought low.

Pause High Level: In this mode acquisition is active when the Trigger In line of the BioNex is low and paused when it is brought high.

Note: The Pause Low Level and Pause High Level trigger modes are Only available on 8 slot BioNex unit.

BioNex Chassis: This display shows the type of BioNex currently connected to the system. If no hardware was found during initialization, this display will read “No Chassis”.

Chart History Length: This control specifies how many seconds of data are shown on the Acquisition screen at any given time.

Section 2

Subject/Test Number: This control specifies the number/label of the current test subject.

Acquisition Mode: This control specifies how data is acquired. The following acquisition modes are available:

Epoch: In this mode data is collected in segments specified in an epoch file. (See the Epoch File Editor section).

Continuous: In this mode data is collected without pre-defined pauses or segmentation.

File Mode: This control specifies how the data is saved to a file. The following file modes are available:

Append: In this mode each time acquisition is started and stopped the data collected is appended to the end of the current file being written. Once the Acquisition screen is closed, the file can no longer be appended with additional data.

Write Over: In this mode, if acquisition is stopped and restarted, the file will be overwritten with new data.

Auto Name: In this mode the user chooses a base name for the file and BioLab automatically adds a number to the end of the filename corresponding to the current acquisition number. Each time acquisition is stopped and restarted this number is incremented by 1.

Note: The Append file mode is NOT available on Windows 7/8/10 when video recording has been enabled.

Acquisition Source: This control specifies the source of data acquisition. The following sources are available:

BioNex: This mode uses the detected BioNex for data acquisition.

Ambulatory Wi-Fi: This mode uses network devices for data acquisition

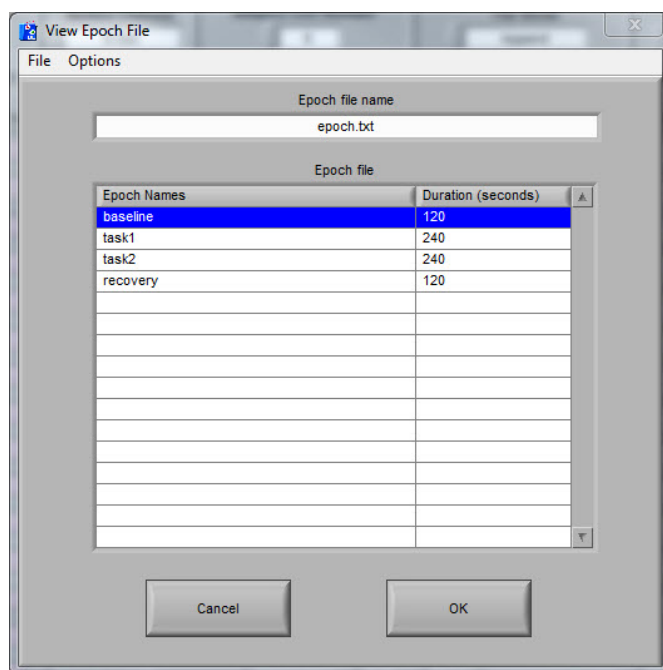
BioNex & Ambulatory Wi-Fi: This mode uses a combination of the detected BioNex and connected network devices for data acquisition.

File: This mode opens a MindWare data file for viewing/playback.

Epoch File Name: This display shows the epoch file currently selected for use when in the Epoch acquisition mode.

Section 2

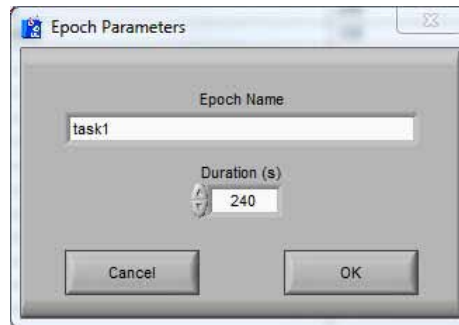
Epoch File Editor: This control allows the user to select a new epoch file for use in acquisition, or edit the currently selected epoch file. Clicking this button brings up the Epoch File Editor screen.



From this screen, a new epoch file can be loaded or the current epoch file can be edited. By selecting an epoch and right-clicking on the Epoch File table or opening the Options menu, the following options are available (next page):

Section 2

Edit Epoch: This option launches the Epoch Parameters window and allows the user to edit the currently selected epoch's name and duration.



Insert Epoch Before: This option once again launches the Epoch Parameters window, but allows the user to define a new epoch to be inserted before the currently selected epoch in the file.

Insert Epoch After: This option behaves the same as above, except it inserts the new epoch after the currently selected epoch in the file.

Remove Epoch: This option allows the user to remove the currently selected epoch from the file. User confirmation is required prior to removing the epoch.

From the menu bar in the Epoch Editor the following options are available:

File:

Open: This option is used to open a new epoch file.

Save As: This option allows the user to save changes made to the current epoch file.

Close: This option closes the Epoch Editor and returns to the BioLab Configuration screen.

Options: This menu contains the same epoch editing options as are available through right-clicking the Epoch File table.

If an epoch file has been edited, the user will be prompted to save the changes made prior to opening a new epoch file or returning to the BioLab Configuration screen.

Section 2

Sub Menu Settings

Below the main settings listed above are several submenus, each containing settings pertaining to a specified aspect of data acquisition. The following submenus are available:

Channels:

The Channels submenus contain adjustable settings for each individual channel present in this system. These settings can apply to the channels available in a BioNex (BioNex acquisition mode), on connected Ambulatory units (Ambulatory Wi-Fi acquisition mode), a combination of the two (BioNex and Ambulatory Wi-Fi acquisition mode), or the channels available in a MindWare file (File acquisition mode).

Events:

The Events submenu contains settings for synchronous and asynchronous digital events as well as keyboard events that can be inserted during the current data acquisition session.

Chart Attributes:

The Chart Attributes submenu allows the user to modify how the data is displayed on the Acquisition screen.

Audio/Video:

The Audio/Video submenu contains settings for the acquisition of video and audio. This tab will not be shown if no MindWare video components are present in the system.

Trending:

The Trending submenu allows users to assign trends (mean, max, min, etc.) to different channels enabled for acquisition that will be calculated and displayed during acquisition.

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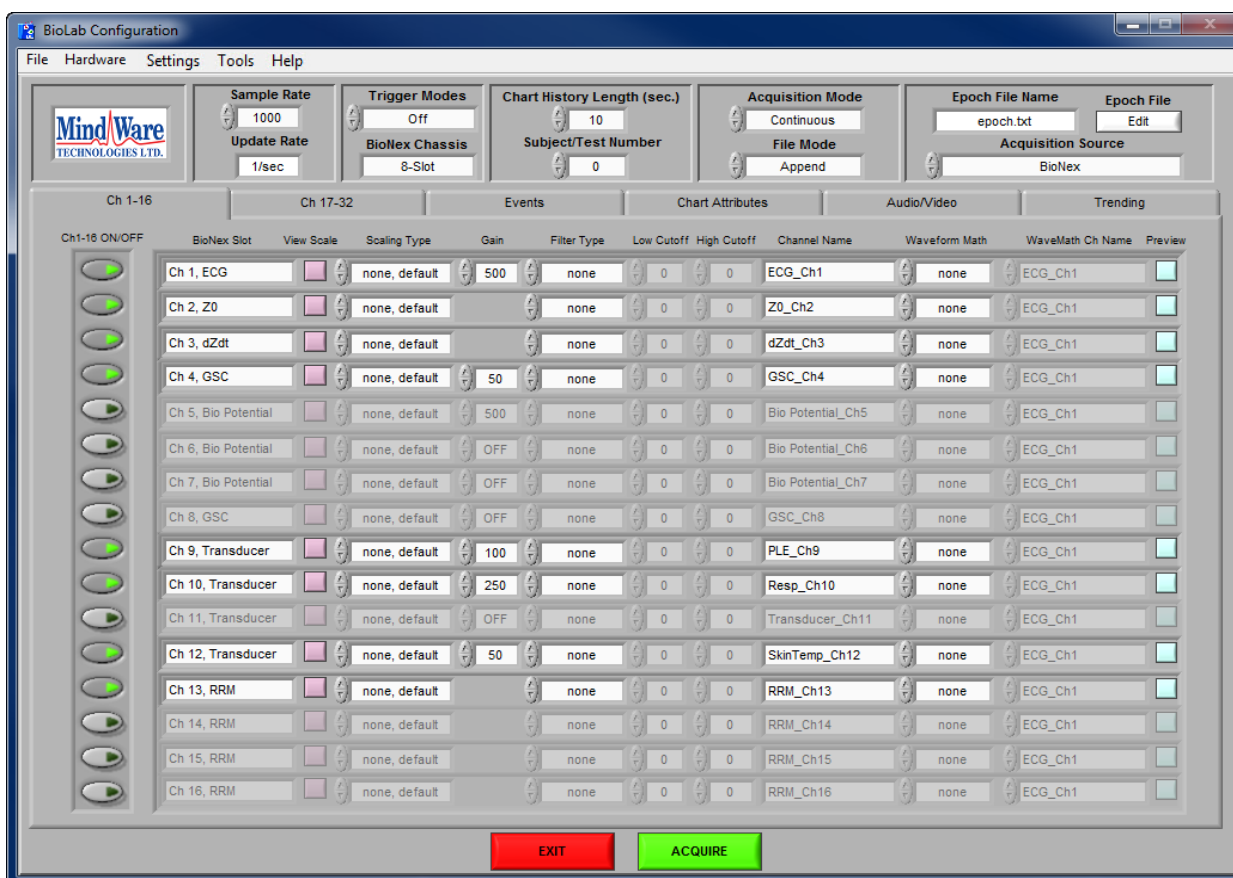
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Part 1: Channels

The Channels submenu contains settings that are applied to the individual channels present in the system. They are listed in order from the module in Slot 1 – 8 when acquiring from a BioNex, or by the order in which the units were connected when acquiring from an from network devices. The following settings (from left to right) are available for each channel:



On/Off: This control enables/disables the specified channel for acquisition. In order for the channel to be enabled, there must be a module in the corresponding slot.

Note: Channel On/Off is disabled when collecting from network devices.

BioNex Slot: This display indicates the type of data that can be collected with the module currently in that position. This is also the formal name of the channel on the module. If there is no module in the corresponding slot, this display will display “empty slot” next to the channel number.

View Scale: This button launches the Preview Scaling screen, which allows users to see the affects of various scaling methods on the channel. This screen is discussed in more detail in Part 1a.

Section 2

Scaling Type: This control sets the type of scaling to use on the specified channel. By selecting any scaling method other than “None, default” the Preview Scaling screen is automatically launched. There are three scaling methods available:

None, default: No scaling will be used on this channel.

Map Ranges: Maps the voltage range to the scaled units (e.g. 1V = 100 mmHg).

Slope Intercept: Scales volts to specified scaled units using the equation $y = mx + b$ where m is the slope and b is the intercept.

Gain: This control adjusts the amount of gain to be applied to each channel. Depending on the type of channel, different gain settings are available. If a channel does not have a programmable gain setting associated with it, this control will not be visible.

Note: The user will be unable to proceed to the Acquisition screen until all enabled channels have a gain setting other than ‘OFF’ or ‘0’.

Filter Type: This control specifies the filter that will be used on the channel while acquiring data. Each filter has a default Low and High Cutoff associated with it.

Low Cutoff: This control sets the low cutoff frequency for the specified channel. This control will be disabled when no filter has been selected, or if the selected filter ignores or uses a very specific low cutoff frequency. This value cannot exceed half the value of the sampling frequency, and must be less than the value of the high cutoff frequency.

High Cutoff: This control sets the high cutoff frequency for the specified channel. This control will be disabled when no filter has been selected, or if the selected filter ignores or uses a very specific high cutoff frequency. This value cannot exceed half the value of the sampling frequency, and must be greater than the value of the low cutoff frequency.

Note: The Nyquist Criterion states that “The exact reconstruction of a continuous time-based baseband signal from its samples is possible if the signal is band-limited and the sampling frequency is greater than twice the signal bandwidth”. This is the reason for the limitations on low and high cutoffs as listed above.

Channel Name: This control allows the user to define the channel name. This will be used to identify the channel both on the acquisition screen and in the MindWare file.

Section 2

Waveform Math: This control sets the type of waveform math to be applied to the specified channel. The following options are available:

None: No waveform math will be applied to this channel.

Add: The channel listed in the WaveMath Ch Name field will be added to the current channel during acquisition.

Subtract: The channel listed in the WaveMath Ch Name field will be subtracted from the current channel during acquisition.

Integrate: The integral of the current channel will be calculated and displayed during acquisition.

Differentiate: The derivative of the current channel will be calculated and displayed during acquisition.

WaveMath Ch Name: Specified the channel that will be added or subtracted from the current channel. All currently enabled channels are available for selection from this list. This control will only be enabled if “Add” or “Subtract” waveform math has been selected.

Preview: This button launches the Preview Scaling and Filtering screen, which allows the user to see the affects of various scaling, filtering, and waveform math settings on the specified channel. This screen is discussed in more detail in Part 1b.

Part 1a: Preview Scaling



The Preview Scaling screen is used to see how various scaling methods can affect the channel to which they are being applied. The following settings are available:

Preview Update Rate: This control sets how often the Preview Scaling screen is updated (in updates per second).

Chart Type: This control specifies how the data is viewed on the Preview Scaling screen. There are two different chart options:

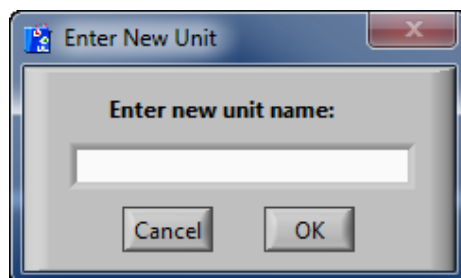
Stacked Chart: The option plots unscaled data (volts) and scaled data (scaled units) in separate charts stacked on one another. (Shown above)

Overlay Chart: This option plots both the unscaled and scaled data on the same plot.

Channel Gain: This control specifies the programmable gain setting to be used on this channel. It is initialized to its value on the BioLab Configuration screen and can be changed to see how different gain settings affect signal amplitude, etc.

Section 2

Scaled Unit: This control specifies the unit that the signal is being scaled to. There is a default list of units available, but by selecting the New Unit... option the following window will appear allowing the user to add a custom unit description.



If a new unit is successfully added, it will appear in the list as a selectable unit and saved for use in future sessions.

Note: This control will be disabled if no scaling method has been selected.

Channel Name: This control allows the user to switch between channels which have been enabled for acquisition. When a new channel is selected, the controls on this screen will be updated to reflect that channel's settings.

Scaling Method: This control sets the type of scaling to use on the specified channel. There are three scaling methods available:

None, default: No scaling will be used on this channel.

Map Ranges: Maps the voltage range to the scaled units (e.g. 1V = 100 mmHg).

Slope Intercept: Scales volts to specified scaled units using the equation $y = mx + b$ where m is the slope and b is the intercept.

Volts Max: This control is available for the Map Ranges scaling method, and sets the maximum voltage of the signal.

Volts Min: This control is available for the Map Ranges scaling method, and sets the minimum voltage of the signal.

Measure Max: This control is available for the Map Ranges scaling method, and sets the maximum range voltage.

Measure Min: This control is available for the Map Ranges scaling method, and sets the minimum range voltage.

m (slope): This control is available for the Slope Intercept scaling method, and sets the slope of the scaling equation.

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b (y-intercept): This control is available for the Slope Intercept scaling method, and sets the y-intercept of the scaling equation.

Acquiring: This button toggles between acquiring a signal from the specified channel and pausing acquisition to examine the data.

Cancel: This button returns to the BioLab Configuration screen without saving any changes made to channel scaling.

OK: This button returns to the BioLab Configuration screen saving all changes made to the channel scaling while in the Preview Scaling window.

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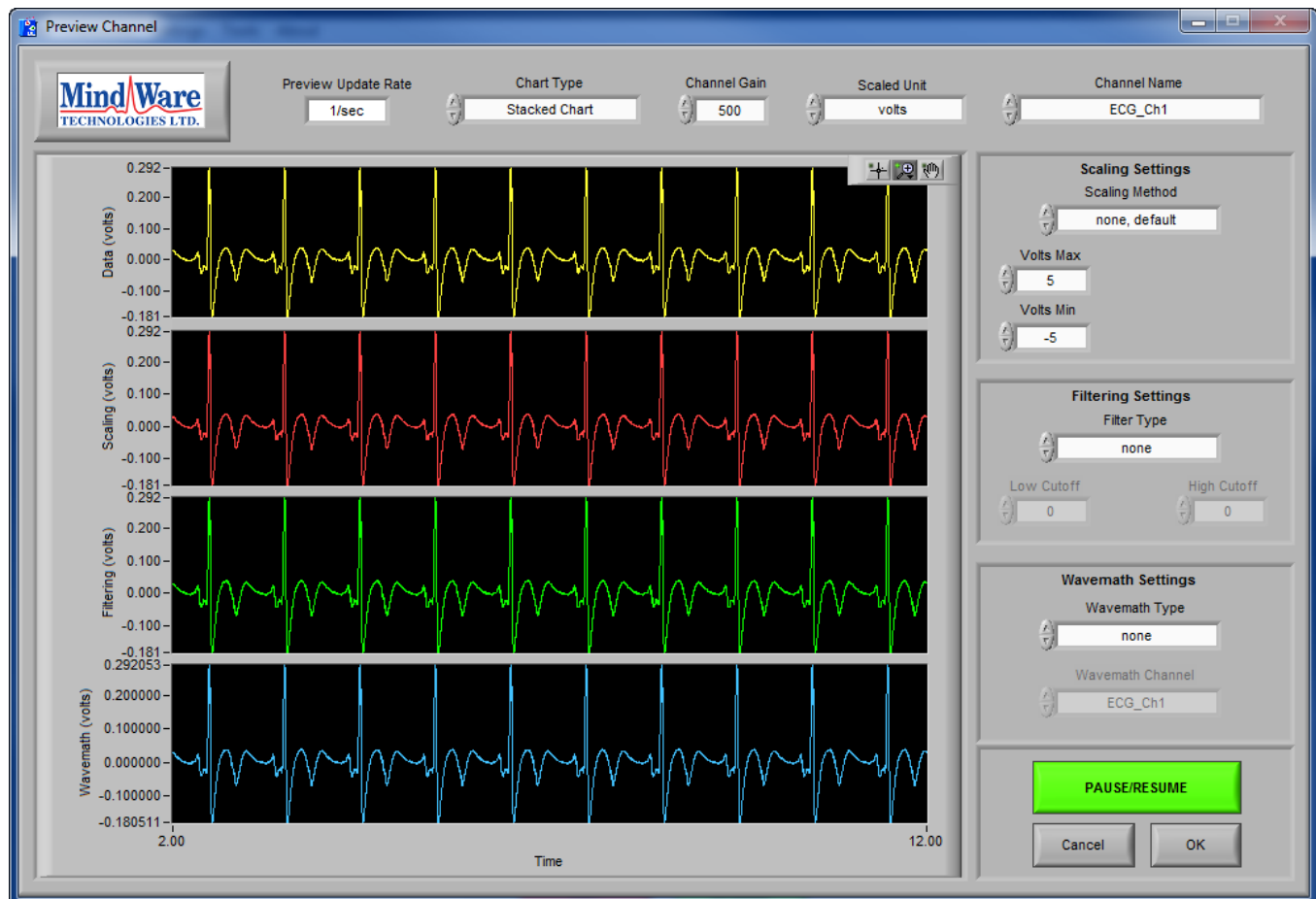
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Part 1b: Preview Channel

The Preview Channel screen is used to see how various scaling methods can affect the channel to which they are being applied. The following settings are available:



Preview Update Rate: This control sets how often the Preview Channel screen is updated (in updates per second).

Chart Type: This control specifies how the data is viewed on the Preview Channel screen. There are two different chart options:

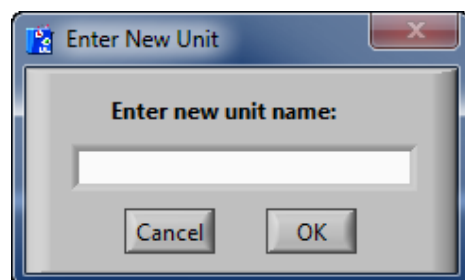
Stacked Chart: The option plots unscaled data (volts), scaled data (scaled units), filtered data (scaled units), and post-wavemath data (scaled units) in separate charts stacked on one another. (Shown above)

Overlay Chart: This option plots the unscaled, scaled, filtered, and post-wave math data on the same plot.

Section 2

Channel Gain: This control specifies the programmable gain setting to be used on this channel. It is initialized to its value on the BioLab Configuration screen and can be changed to see how different gain settings affect signal amplitude, etc.

Scaled Unit: This control specifies the unit that the signal is being scaled to. There is a default list of units available, but by selecting the **New Unit...** option the following window will appear allowing the user to add a custom unit description.



If a new unit is successfully added, it will appear in the list as a selectable unit and saved for use in future sessions.

Note: This control will be disabled if no scaling method has been selected.

Channel Name: This control allows the user to switch between channels which have been enabled for acquisition. When a new channel is selected, the controls on this screen will be updated to reflect that channel's settings.

Scaling Settings: These settings behave the same way as those found in the Preview Scaling screen.

Filter Settings: These settings behave the same way as those found in the BioLab Configuration screen.

Wavemath Settings: These settings behave the same way as those found in the BioLab Configuration screen.

Acquiring: This button toggles between acquiring a signal from the specified channel and pausing acquisition to examine the data.

Cancel: This button returns to the BioLab Configuration screen without saving any changes made to channel settings.

OK: This button returns to the BioLab Configuration screen saving all changes made to the channel settings while in the Preview Scaling and Filtering window.

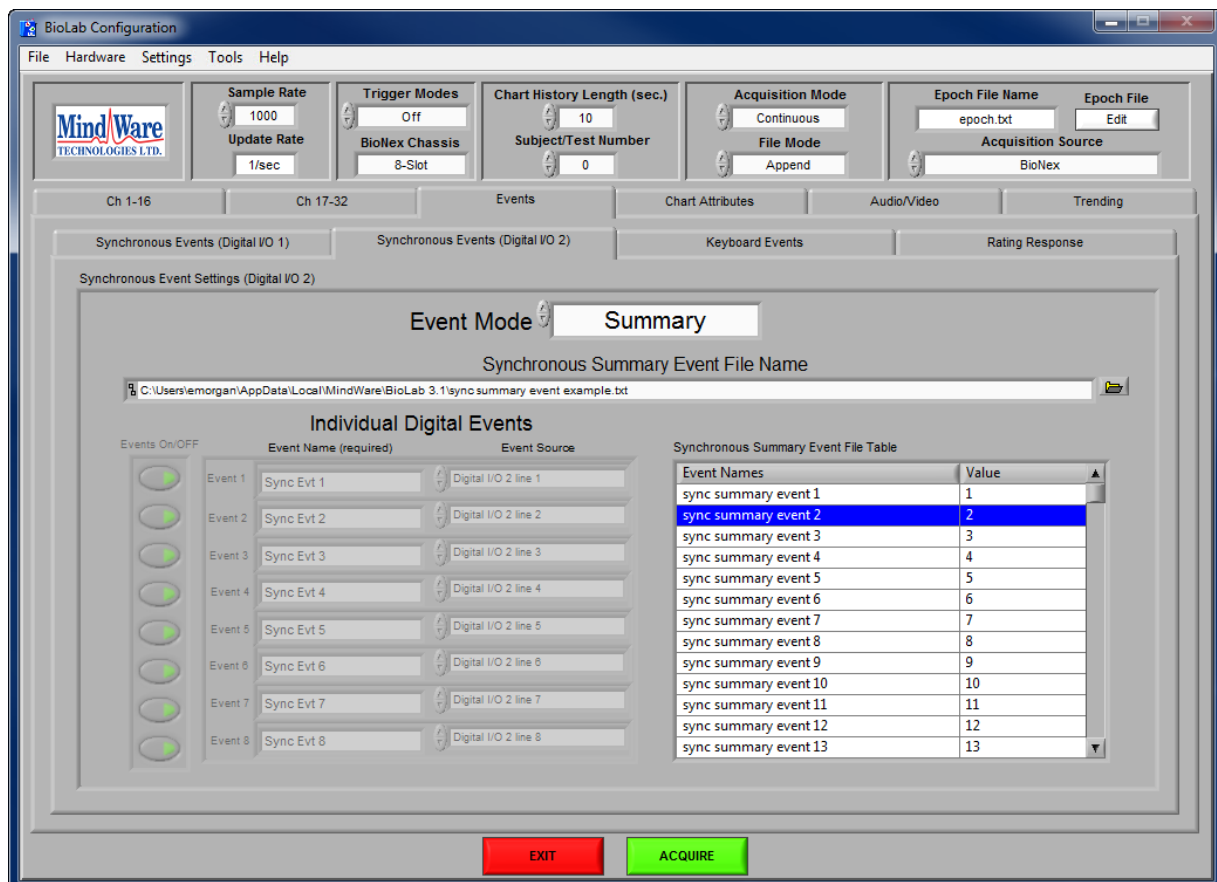
Section 2

Part 2: Events

The Events submenu contains settings for synchronous and asynchronous digital events as well as keyboard events that can be inserted during the current data acquisition session. Within the Events submenu, there are three additional categories: Synchronous Events, Asynchronous Events, and Keyboard Events.

Part 2a: Synchronous Events

The Synchronous Events submenu contains setup options for configuring the synchronous digital I/O on the BioNex. Synchronous events are sampled at the same sampling frequency, and therefore are in sync with the acquired data. The signals enabled in this submenu are displayed on the Acquisition screen and saved in the MindWare file.



Note: This submenu will not be available for users with a 2-slot BioNex, as it does not support synchronous events.

Section 2

The following Synchronous Event settings are available:

Event Mode: This control changes the behavior of the synchronous digital lines. There are three event modes:

Off: This mode disables synchronous events from occurring during acquisition.

Individual: This mode views each synchronous digital line as a completely separate event channel, allowing for up to 8 distinct events (one for each available digital line).

Summary: This mode views the synchronous digital lines as a single event channel, with its value being the sum of all values seen on each digital line. This allows for 255 distinct events. All digital lines will be automatically enabled when in this mode.

Synchronous Summary Event File Name: This control is used to load a summary event file. The contents of the file are shown in the Synchronous Summary Event File Table.

Individual Digital Events: These controls are used to define the parameters used in collecting individual digital events and will only be enabled when in Individual event mode. There are three fields in this section:

Events On/Off: Enables/disables a specific digital line for use during acquisition. The digital line must be enabled in order to use it for data acquisition.

Event Name (required): This control allows the user to define the digital event name. The name entered in this control will be used not only to identify the channel on the Acquisition screen, but also in the MindWare file and its associated Event file.

Event Source: This control specifies the specific digital line on the BioNex that is associated with the current event.

Synchronous Summary Event File Table: This table lists the names and values of the summary events as read from the specified summary event file. By selecting an event on the list and right-clicking, there are three options for editing the current summary event file:

Edit Event: Selecting this option will launch the following window, allowing for the selected event to be given a new name or value associated with it.

Section 2

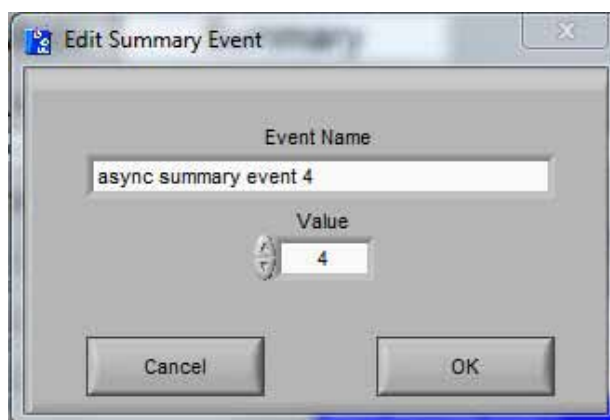
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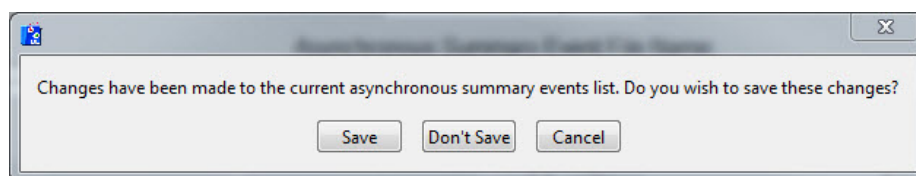


If the chosen Event Name or Value has already been used in the summary event file, an error will be given and the event will need to be changed prior to inserting it back into the file.

Add Event: Selecting this option will once again launch the Edit Summary Event screen, this time allowing the user to add a new event to the list. The same requirement that an event not contain duplicate values still applies.

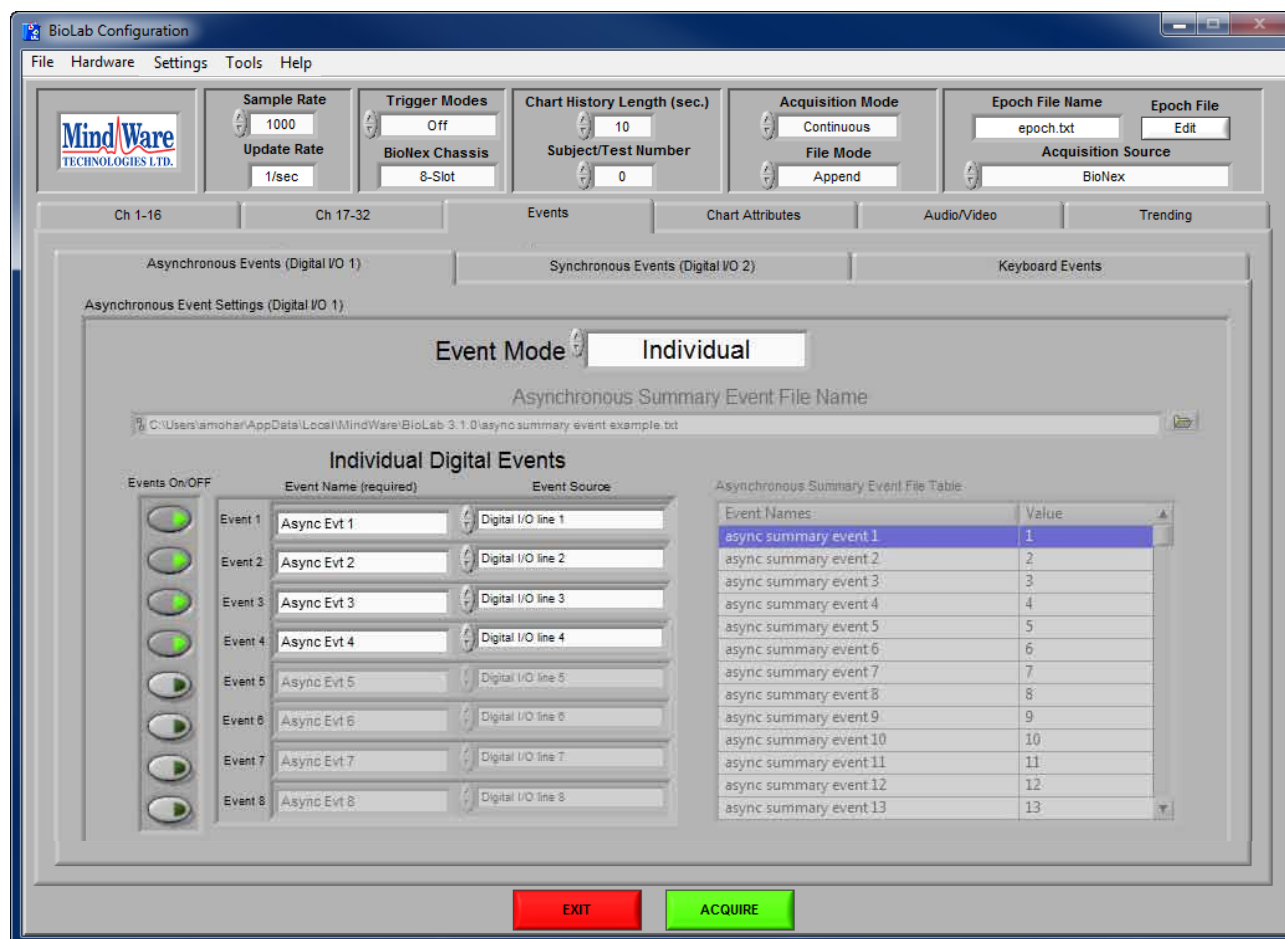
Remove Event: Selecting this value will allow the user to remove a summary event from the list. User confirmation is required prior to actual removal of the event.

If any changes are made to this file through adding, removing, or editing events, the user will be prompted to save these changes prior to acquiring, exiting, or changing the current submenu.



Cancelling at this point will return to the Synchronous Events submenu for the user to re-evaluate the changes made to the summary events.

Part 2b: Asynchronous Events



The Asynchronous Events submenu contains setup options for configuring the asynchronous digital I/O on the BioNex. Asynchronous events are sampled at ~500 samples per second, and are not guaranteed to be in sync with the acquired data. The signals enabled in this submenu are not displayed on the Acquisition screen or saved in the MindWare file, but events detected on these lines will appear in the associated Event file.

Note: Users with a 2-slot BioNex will only have access to four asynchronous digital lines for a total of 4 individual events and 16 summary events. Newer 8 slots will have another bank of Synchronous events in place of this sub menu.

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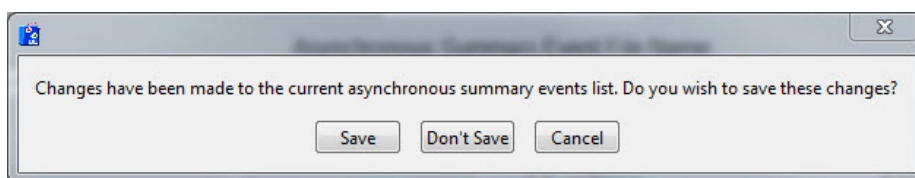
Event Mode: This control behaves the same as it does on the Synchronous Events submenu.

Asynchronous Summary Event File Name: This control is used to load a summary event file. The contents of the file are shown in the Asynchronous Summary Event File Table.

Individual Digital Events: These controls behave the same way as they did on the Synchronous Events submenu with the exception of the Event Source field. If there are Rating Response Modules present in the BioNex, the event source can be mapped to the right or left buttons on the rating response controller so that these can be sampled asynchronously.

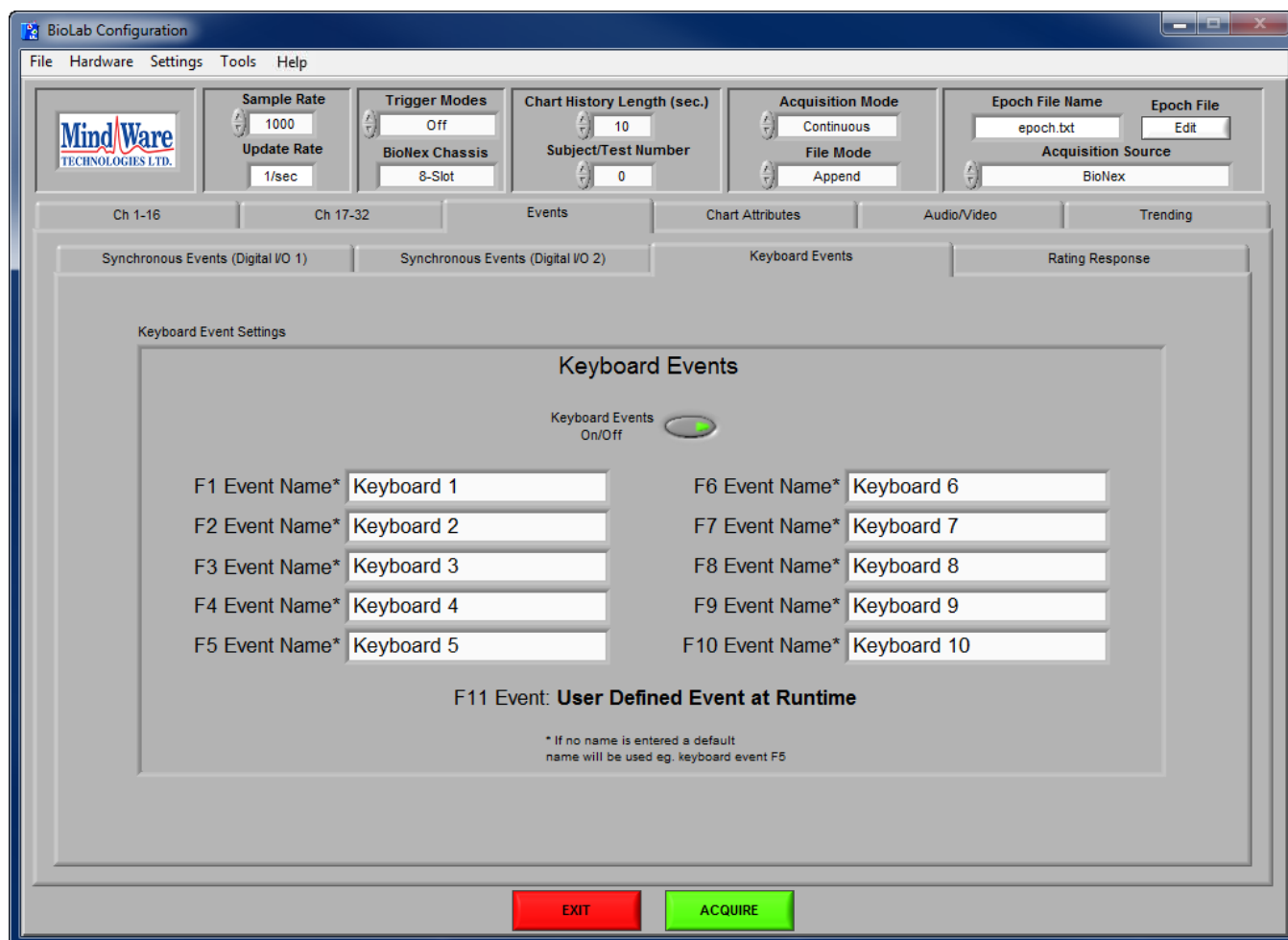
Asynchronous Summary Event File Table: This table behaves the same as the Synchronous Summary Event File Table on the Synchronous Events submenu.

Once again, if changes are made to this file through adding, removing, or editing events, the user will be prompted to save these changes prior to acquiring, exiting, or changing the current submenu.



Cancelling at this point will return to the Asynchronous Events submenu for the user to re-evaluate the changes made to the summary events.

Part 2c: Keyboard Events



The Keyboard Events submenu contains settings for configuring the keyboard events available to the user during acquisition. The following settings are available:

Keyboard Events On/Off: This control enables/disables use of keyboard events during acquisition.

Keyboard Event Names: These fields describe how the keyboard event will be identified on the Acquisition screen as well as in the data file saved during acquisition. If there is no name specified, a default name will be used based on the key from which the event was detected.

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Part 2d: Rating Response Events

The screenshot displays the 'BioLab Configuration' window. The 'Settings' menu is active, and the 'Rating Response' submenu is selected. The 'Rating Response Event Settings' panel is visible, featuring a toggle for 'RRM Events On/Off' (currently 'On'). Below this, there are eight text input fields for event names, labeled 'Event 1 Name*' through 'Event 8 Name*'. Each field contains the text 'RRM Event 1' through 'RRM Event 8' respectively. A note at the bottom of the panel states: '* If no name is entered a default name will be used eg. RRM Event 1'. At the bottom of the window, there are two buttons: 'EXIT' (red) and 'ACQUIRE' (green).

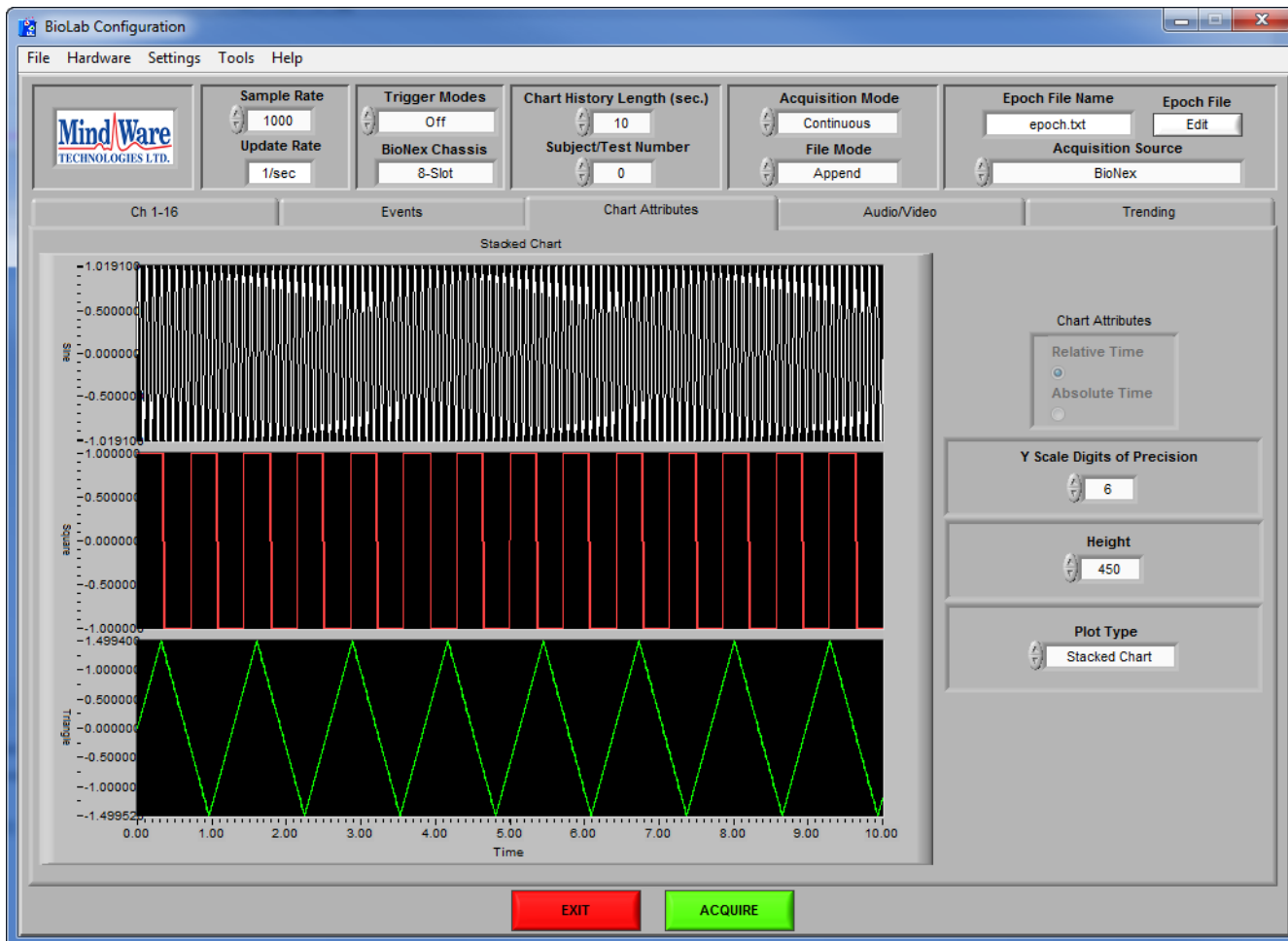
The Rating Response submenu contains settings for configuring the events obtained from Rating Response modules in the system. This submenu will only be available when using a newer model 8-slot BioNex. Rating Response events are captured asynchronously, and up to 8 unique events can be captured (2 per channel).

The following settings are available:

RRM Events On/Off: This control enables/disables use of Rating Response events during acquisition

RRM Event Names: These fields describe how the rating response event will be identified on the Acquisition screen and in the MWI file

Part 3: Chart Attributes



The Chart Attributes submenu contains settings for adjusting how the data is displayed on the Acquisition screen. The following settings are available:

Y Scale Digits of Precision: This control sets the number of significant digits the chart will display on the y-axis.

Height: This control sets the height of each plot on a stacked chart. It is only available when using stacked charts, as the other display types auto-size to the Acquisition screen.



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Plot Type: This control sets the type of display used to show the data on the Acquisition screen. There are three types of displays available:

Overlaid Chart: This display type plots all acquired signals on a single chart. These signals can be offset from one another to improve visibility through use of the Display Spacing control.

Stacked Chart: This display type stacks plots on top of one another, each with its own unique y-axis which is very useful for viewing signals with radically different amplitudes. The height of these plots can be set by changing the Height control.

Graph: This display type plots all acquired signals on a single graph, but does not retain a history of previously collected data before the current update.

Note: Relative/Absolute time selection is only available in File mode. Acquisition is always done in Relative time

Part 4: Audio / Video



The Audio/Video submenu contains settings for the acquisition of up to 4 A/V streams from the MindWare Video ACQ modules. These settings are only adjustable when 1 or more of these modules are present in the system.

Note: This submenu will only be available if one or more MindWare Video ACQ modules are detected in the system.

This submenu is divided into two sections: one for configuring the first 2 Video ACQ modules detected, and another for configuring the last two modules. The following settings are available for each module:

Record Enable: This control enables/disables the specified Video ACQ module for acquisition. This must be enabled to acquire audio and video with this device.

Camera Name: This control allows the user to define the camera name. The camera name is used in identifying the video stream during acquisition (used as window name for video display).



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Audio Controls: These controls configure the audio recording on the Video ACQ module. The following audio settings are available:

Left Level: This control allows the user to raise or lower the recording level of the left audio channel.

Right Level: This control allows the user to raise or lower the recording level of the right audio channel.

Mic Gain: This control sets the gain on the microphone audio input.

Audio Input: This control specifies the source of the recorded audio. If there is a microphone plugged into the 1/8" stereo input on the Video ACQ module, this should be set to Mic. If there is an audio source plugged into the Line In inputs, this should be set to Line In.

Mute: This control enables/disables audio collection.

Set Line In to Default Levels: This control resets all audio settings to their default levels. If any changes are made to the audio settings, this option is unchecked.

Video Controls: These controls configure the video recording on the Video ACQ module. The following video settings are available:

Contrast, Brightness, Saturation, Hue: These controls raise and lower the specified video property.

Video Input: This control specifies the source of the recorded video. If there is a video feed plugged into the BNC port on the Video ACQ module, this should be set to Composite. If there is a video feed plugged into the S-Video port, this should be set to S-Video.

Video System: This control specifies type of video feed streaming to the Video ACQ module. The Video ACQ module supports both NTSC and PAL video systems.

Video Resolution: This control specifies the resolution of the acquired video. There are two options available: 360x240 and 720x480. A higher resolution means a clearer picture, but as resolution increases so does the file size of the resulting video file.

Encoding: This control specifies the codec used to encode the video file. The type of encoding has a large impact on the size of the resulting video file.

Note: The standard encoding is MPEG 4.

Set Video In to Default Levels: This control resets all video settings to their default levels. If any changes are made to the video settings, this option is unchecked.

Section 2

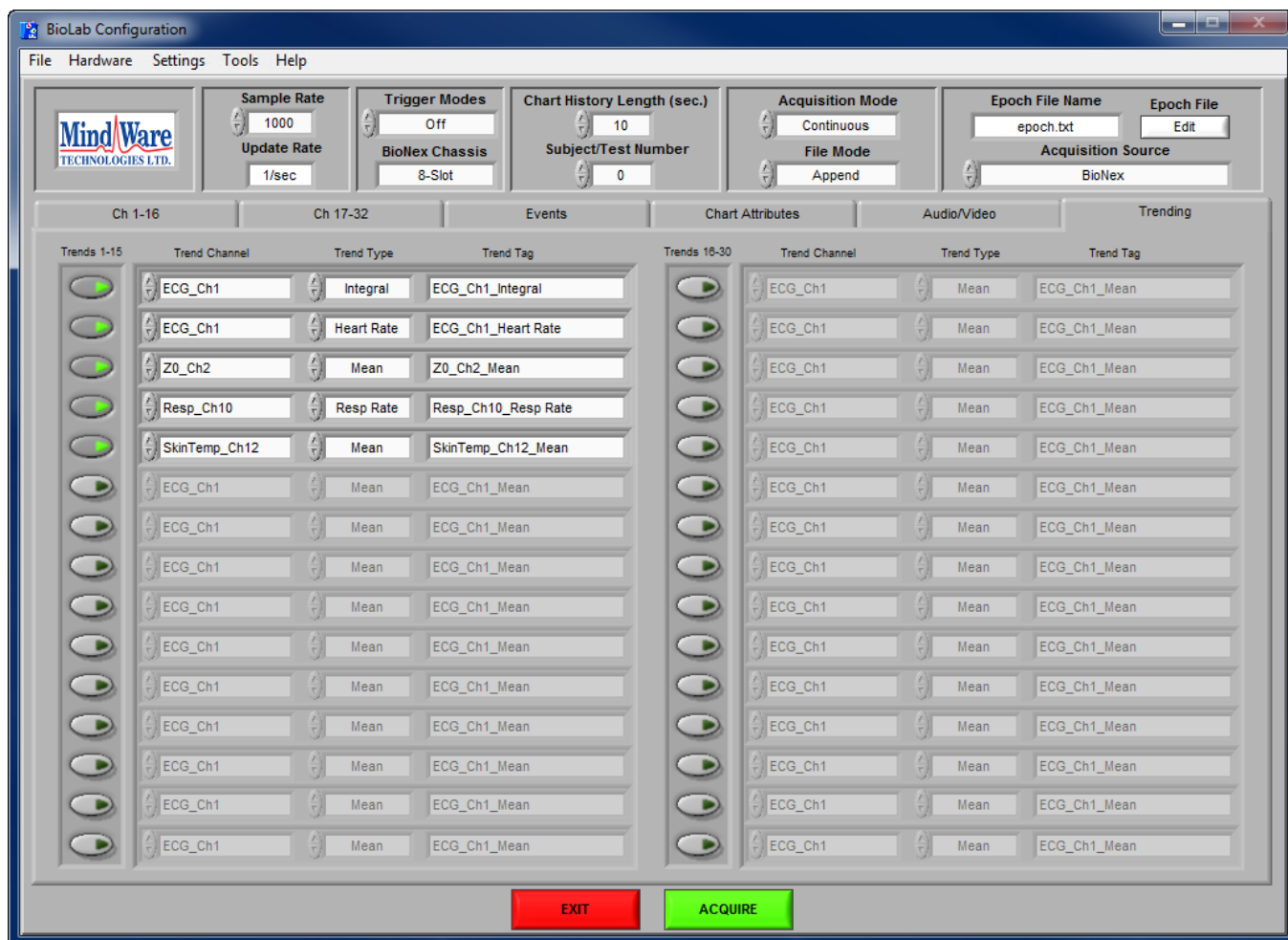
Preview: This control launches/closes the preview window for the specified Video ACQ module to verify the video feed prior to acquisition.

Note: Due to performance limitations, video previews when using 3+ cameras are shown in a lower quality. This does NOT reflect the quality of video being recorded, only the preview video feed.

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Part 5: Trending



The Trending submenu contains settings for specifying trends to be calculated during acquisition. Trends are basic statistical calculations that are graphed and output to a file real time alongside the standard data acquisition. Up to 30 trends can be computed and displayed simultaneously, and can be applied to any channel enabled for acquisition. The following settings are available:

Trend On/Off: This control enables/disables the specified trend. The trend must be enabled for it to be calculated and displayed during acquisition.

Trend Channel: This control specifies the channel to which the trend will be applied. All enabled channels (from the Channel submenu) are available for trending.

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Trend Type: This control specifies the type of calculation to be performed. The following calculations are available:

Mean: Calculates the average value of the specified channel.

Max: Measures the maximum value of the specified channel.

Min: Measures the minimum value of the specified channel.

RMS: Calculates the root mean square (RMS) of the specified channel.

Integral: Calculates the integral of the specified channel.

DC: Measures the DC component of the specified channel.

AC: Measures the AC component of the specified channel.

Heart Rate: Measures rate in beats per minute of an ECG channel.

Resp Rate: Measures rate in breathes per minute of a respiration channel.

Trend Tag: This control allows the user to define a tag with which to identify the trend during acquisition. The trend tag is used to identify the trend in both the Trending Acquisition screen and the trend output file. When the Trend Type is changed, this field is automatically set to a default tag with the following format:

Trend Channel Name_Trend Type

If at any time a channel which has a trend applied to it is disabled, all trends applied to that channel will also automatically be disabled.

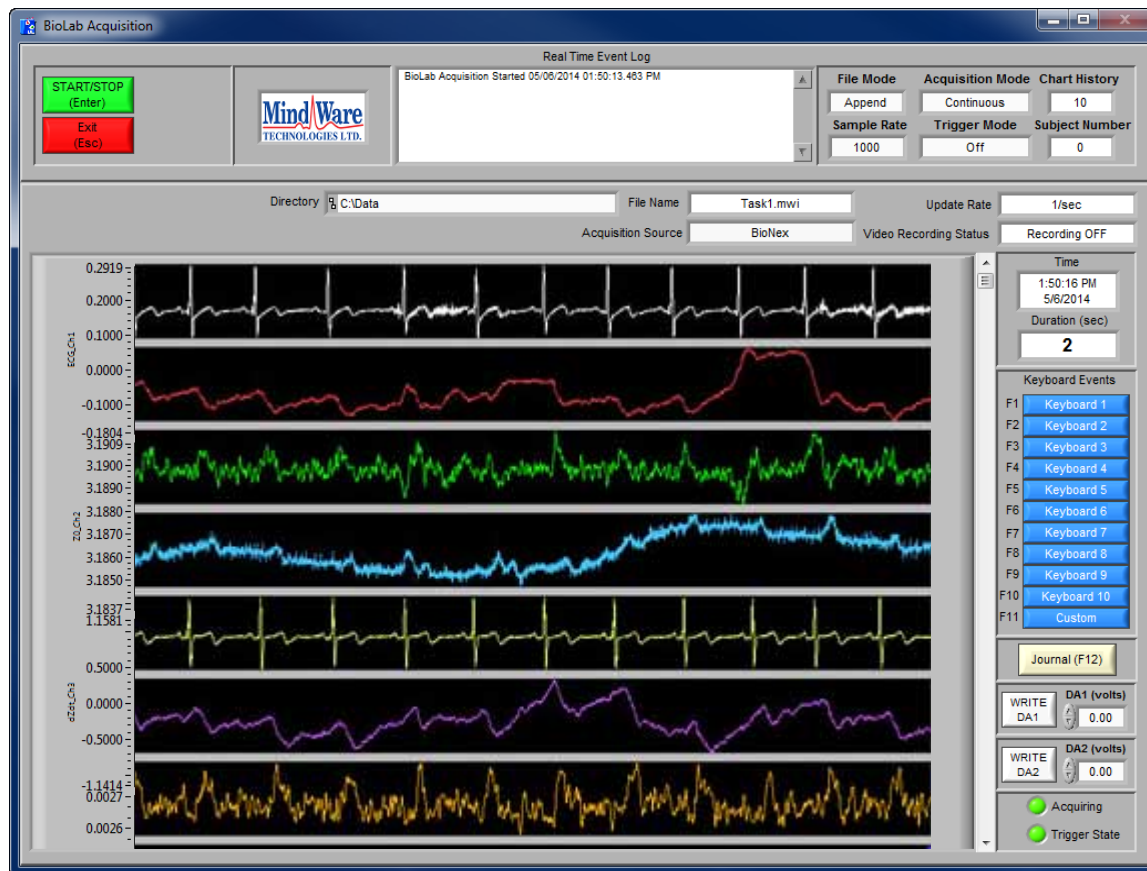
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BioLab Acquisition

The BioLab Acquisition screen is the main acquisition window where all data being acquired will be displayed in real time.

Upon entering the Acquisition screen, the user will be prompted to select a file name for the MWI file. If the acquisition mode has been set to Epoch, the user will be instead prompted to select a directory for the files to be created (in Epoch mode, file names are predetermined by the name of the current epoch). User confirmation is required prior to writing over any existing files.



In the upper left corner of the screen are the acquisition controls. When in Continuous acquisition mode, following controls are available which control the acquisition:

Section 3

Start/Stop (Enter): This control starts or stops acquisition. When in Rising or Falling trigger modes, this control will only be able to stop acquisition as it must be started by a rising or falling edge on the trigger in line. When in Pause High Level or Pause Low Level trigger modes, this control will always be disabled as acquisition is entirely controlled through the trigger line.

Exit (Esc): This control exits the BioLab Acquisition screen and returns to the BioLab Configuration screen.

When in Epoch acquisition mode, the following additional controls are available:



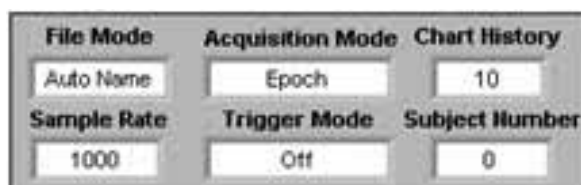
Accept: Once the current epoch has been acquired, this control is used to accept the epoch as valid and proceed to collecting the next epoch.

Replay: If the collected epoch is invalid for any reason, this control is used to repeat acquisition of the current epoch.

Epoch List: This table shows the current epoch being collected as well as all future epochs as defined in the specified epoch file.



Beside the acquisition controls is the **Real Time Event Log**. This log details every event detected during acquisition from synchronous digital events, asynchronous digital events, and keyboard events. These events are labeled by event type, event name, and time which the event occurred. All events listed in this log are written to an event file for use in file playback (see **Section 7: File Viewer**) or in the MindWare Physiological Analysis Suite.



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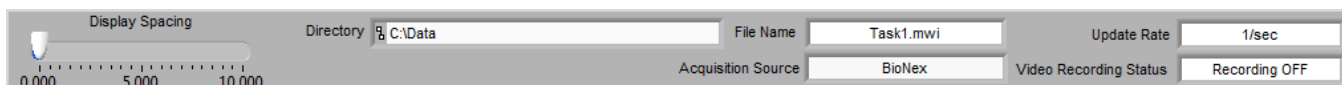
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To the right of the Real Time Event Log are several acquisition setting displays which indicate how acquisition was configured on the BioLab Configuration screen. If these values do not indicate the desired acquisition settings, they can be altered by returning to the BioLab Configuration screen and making the necessary adjustments.



Directly above the data display are additional acquisition setting displays. The following settings are shown:

Display Spacing (volts): From the Chart Attributes submenu, this control specifies the amount of offset between each channel when using a Waveform Chart or Graph display. This control is defaulted to the value set on the BioLab Configuration screen, but is adjustable.

Note: The display spacing only affects the display on the BioLab Acquisition screen and does not apply to the data written to the file.

Default Path: This display indicates the directory in which the current .mw data file will be saved.

File Name: This display indicates the name of the current .mw file.

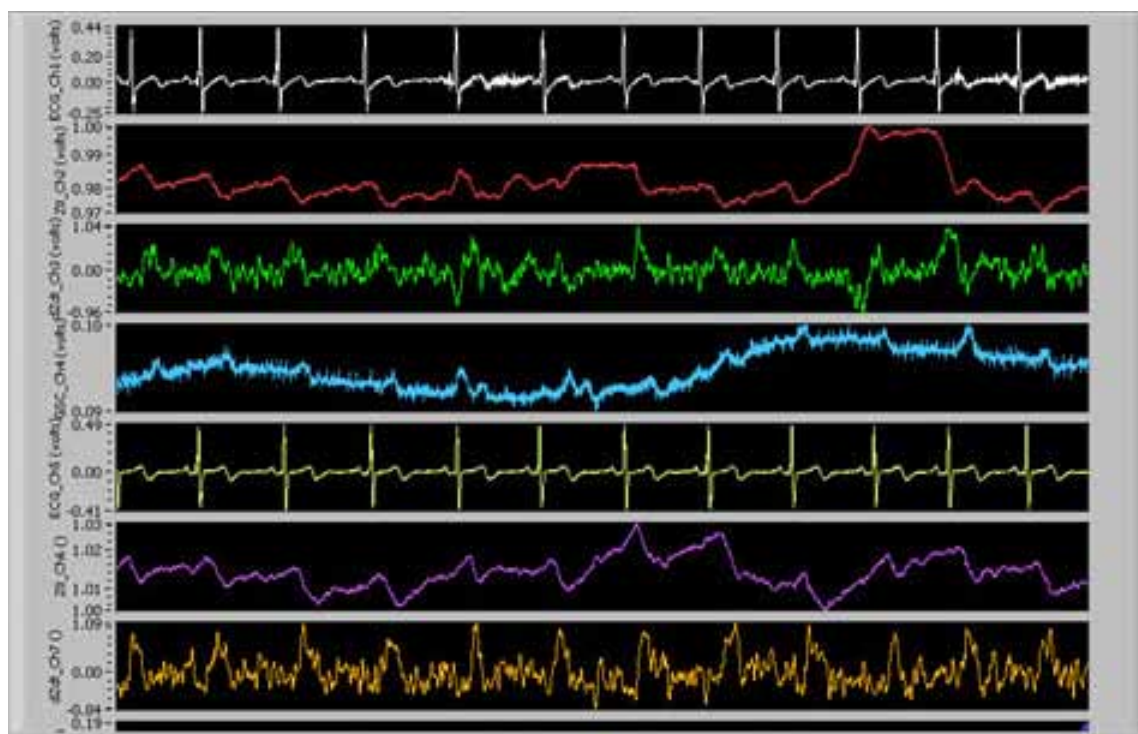
Update Rate: This display specifies how often the display will be updated with new values.

Acquisition Source: This display indicates the source of the data being displayed.

Video Recording Status: This display shows the status of the A/V recording. When there is no A/V recording enabled, this will read "Recording OFF".

Section 3

The data display shows all data being collected from the enabled channels as well as the enabled synchronous digital event lines. Data is displayed in the chart specified on the Chart Attributes submenu of the BioLab Configuration screen. When using a stacked chart display, the y-axis of each plot is labeled with its corresponding channel name. Otherwise, there is a chart legend immediately to the right of the display listing channel names and their associated plot colors.



By right-clicking on the display, several options are available from the run-time menu:

Autoscale Y: When enabled, y-axis is scaled to show full range of data in window. Otherwise, only shows data between specified values.

Static Analysis: Performs specified static analysis on data within the current window (see Section 8: Static Analysis).

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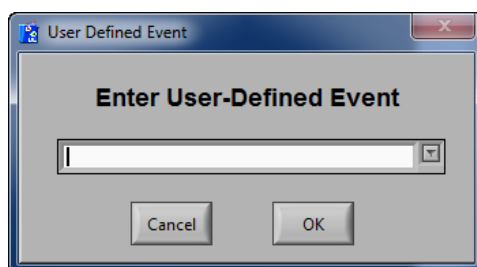
The graph tools in the lower left hand corner of the display have three tools to customize viewing the data. The first tool with the crosshairs can be used when inserting annotations to specify their location. The second tool, the magnifying glass, can be used to zoom in on a particular location in the display. The third tool, the hand, is used to scroll through the data.

Finally, on the right side of the BioLab Acquisition screen are the Time and Event settings. The following controls and displays are located here:

Time: This display shows the current time and date to the nearest second.

Duration: This display shows the duration of the current MindWare file in seconds.

Keyboard Events: These controls are labeled according to the event names set on the Keyboard Events submenu on the BioLab Configuration screen. These are active buttons which insert the specified keyboard event in the event log when pressed. These buttons can also be activated by pressing the corresponding key on the keyboard. Also, by pressing **F11** a user defined event can be entered.

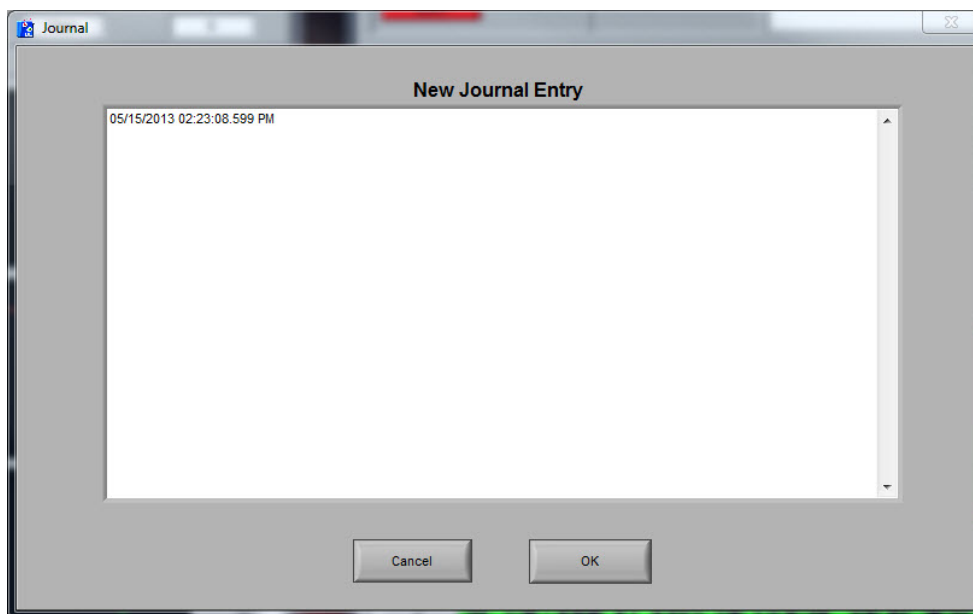


From this window, an event with any definition can be inserted into the file. Previously used event definitions are saved for future use, and accessible from the drop down entry box. Pressing OK inserts the event. Pressing cancel results in the event not being inserted in the file.

Note: Acquisition does not stop while the User-Defined Event window is open.

Section 3

Journal (F12): This control opens the journal window to add a new entry.



Within this window, the New Journal Entry field shows the current entry being made to the journal.

Pressing cancel will exit the journal window without saving the current entry. The OK button will save the current entry to the journal and return to the acquisition screen.

Note: Acquisition does not stop while the journal window is open.

Write D/A 1: This control writes the value specified in the DA1 (volts) control to the DA1 port on the BioNex.

Write D/A 2: This control writes the value specified in the DA2 (volts) control to the DA2 port on the BioNex.

Acquiring: When this LED is on, acquisition is active.

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Trigger State: This LED reflects the current state of the Trigger In line on the BioNex.

If running in **Ambulatory** or **BioNex & Ambulatory Wi-Fi** mode, the connected Mobile units will perform a synchronization routine prior to the start of acquisition. The following screen will appear

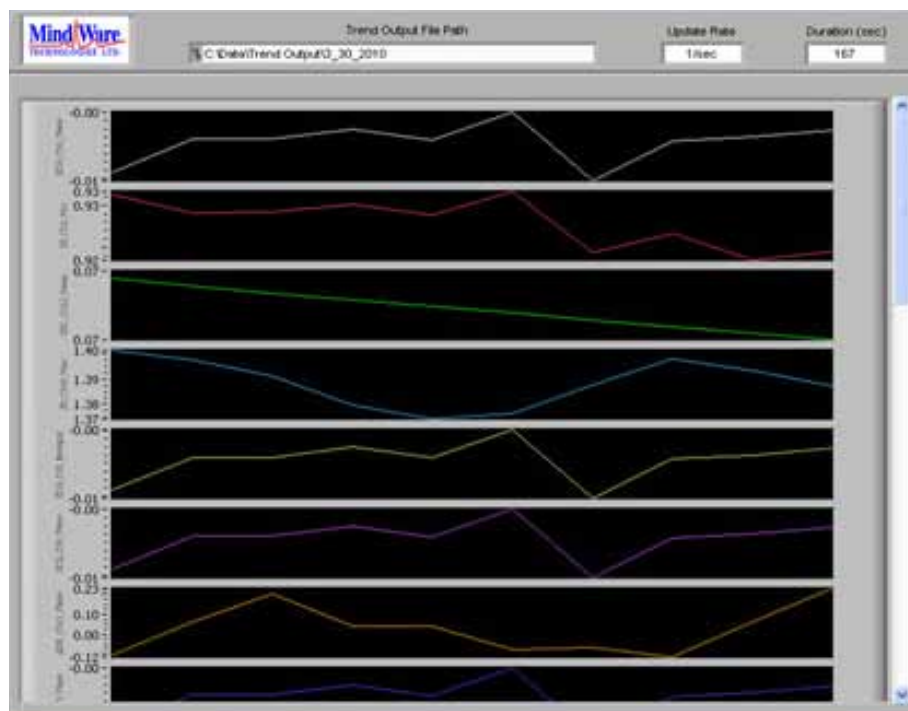


The synchronization process takes less than a minute to execute, and ensures that all data is returned synchronously from the wireless devices.

In the event that a Mobile unit loses connection with the host computer during acquisition, an error message will be displayed and the channels corresponding to the lost device are lost for the remainder of acquisition. All other devices currently in use will continue to acquire

Section 4

Trending



The Trending screen appears during acquisition if at least one trend was enabled on the Trending submenu of the BioLab Configuration screen. The trends are shown in a stacked plot display, with each plot having its own unique y-axis (amplitude) but sharing its x-axis (time) with all other trends. Each trend is labeled along its y-axis with the Trend Tag specified on the BioLab Configuration screen. The graph palette is located in the lower left hand corner.

Across the top of the Trending screen, the following parameters are displayed:

Trend Output File Path: This display indicates the location of the trending output file which is being created during acquisition. This file contains a tab-delimited list of the value of each update for all trends being calculated.

Update Rate: This indicates the rate at which the trends are being calculated and displayed (in updates per second).

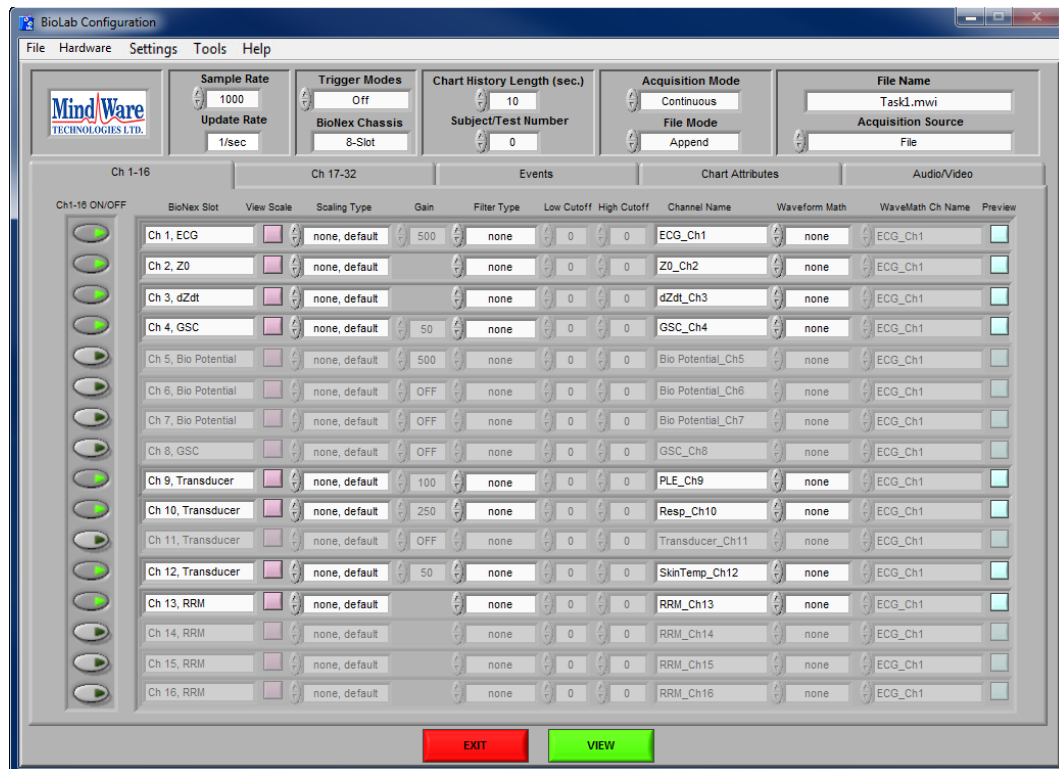
Duration: This display shows the duration of the current Trending file in seconds.

Section 5

BioLab Configuration (File Mode)

Previously recorded MindWare files can be opened in two different ways. Opening a MindWare file by selecting **File >> Open File** or changing the Acquisition Source control in the Main Settings to **File** bring up a window prompting the user to select a file for opening. If the MindWare file to be viewed was just recorded (i.e. just returned from Acquisition screen), clicking on the MindWare logo located in the upper left hand corner of the BioLab Configuration screen will load the most recently recorded MindWare file automatically.

Note: A file dialog box will appear when clicking on the MindWare logo prior to recording a MindWare file during the current session.



When a MindWare file is opened, it is loaded into the BioLab Configuration screen with all of the settings as they were set at the time of the file's recording. All channels which are present in the file are automatically enabled. Also, notice that the button which read "Acquire" has changed to "View". Once again, the configuration screen is divided into three sections: Menu Bar Settings, Main Settings, and Sub Menu Settings.

Menu Bar Settings

The following settings are available from the menu bar:

File:

Open File: This option allows the user to open a new MindWare file for viewing in file playback mode.

Save MindWare File As: This option allows the user to save the currently opened MindWare file as a new file (i.e. if changes have been made to filtering or scaling, channels have been disabled, etc). User confirmation is required prior to writing over any existing MindWare files.

Export Events: Export events from an MWI file to a text file.

Exit: This option closes the BioLab application.

Hardware:

Redetect Devices: This option restarts the BioLab application using the last acquisition source (thus exiting file playback mode), re-initializing all hardware and re-detecting all modules.

Settings:

Open Configuration: This option allows a previously saved configuration file (.mwcfg) to be opened.

Save Configuration As: This option saves all current settings in the BioLab Configuration screen to a configuration file (.mwcfg) which can later be recalled.

Reinitialize All to Default: This option will return all settings to how they are saved in the currently open MindWare file, discarding any changes made to the configuration since opening the file.

Tools:

ASCII-MW Converter: The ASCII-MW Converter allows the conversion of any text file containing data in some character-delimited columns to the .mw format so that it may be used in any application (See Appendix A: ASCII-MW Converter).

Build MWI: Builds an MWI file from an existing MWX file (See Appendix B).

About:

BioLab: This option launches the About window, detailing information about the version of BioLab running.

Show Help: This option toggles on/off the floating help box.

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Main Settings

	Sample Rate 1000 Update Rate 1/sec	Trigger Modes Off BioLex Chassis 8-Slot	Chart History Length (sec.) 10 Subject/Test Number 0	Acquisition Mode Continuous File Mode Append	File Name Task1.mwi Acquisition Source File
--	---	--	---	---	--

The main settings section appears very similar to the settings on BioLab Configuration screen when setting up acquisition, but in File Playback mode these settings are merely indicators showing how acquisition was set up when the file was created.

Detailed descriptions of each of these settings can be found in **Section 2: BioLab Configuration**

Note: Since these settings are only indicators of how the file was acquired, they are not editable. Only the Acquisition Source control can be changed to switch from File to another source.

The Epoch Editor has been replaced with the **File Name** display, which shows the name of the currently opened MindWare file. Below it, the **Acquisition Source** control behaves the same way as it did previously.

Sub Menu Settings

Below the main settings listed above are several submenus, each containing settings pertaining to a specified aspect of the data in the current file. The following submenus are available:

Channels:

The Channels submenus contain adjustable settings for each individual channel present in the file.

Events:

The Events submenu contains settings for synchronous and asynchronous digital event channels present in the file as well as keyboard events that can be inserted during file playback.

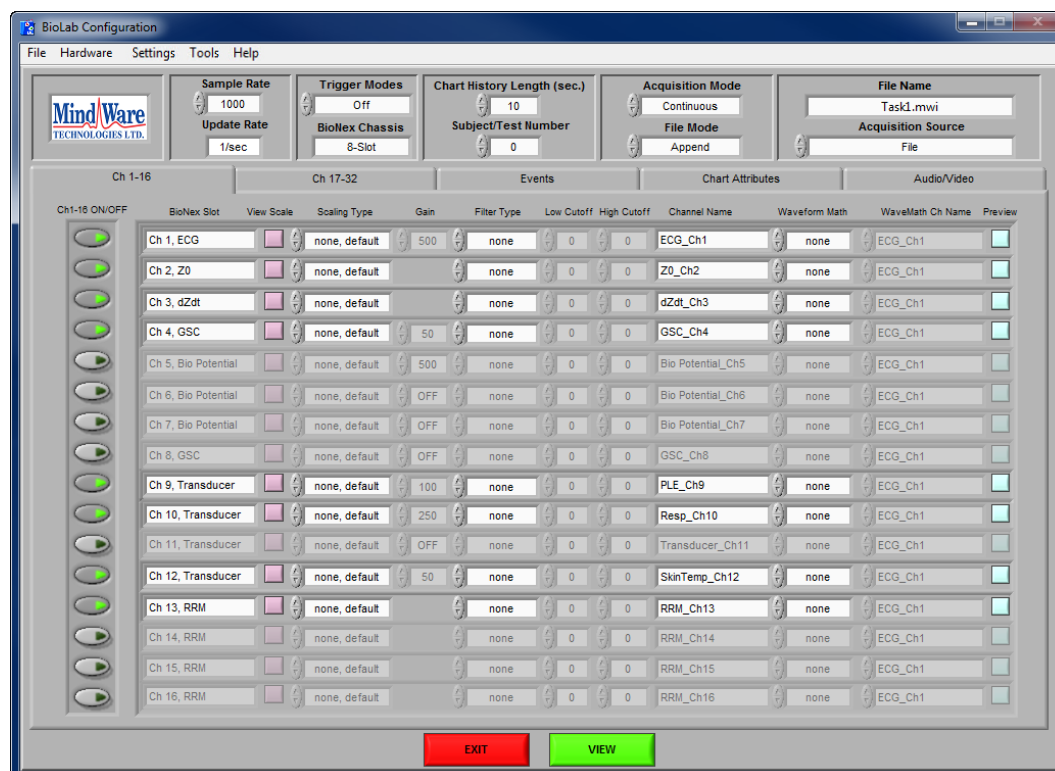
Chart Attributes:

The Chart Attributes submenu allows the user to modify how the data is displayed on the BioLab File Viewer screen.

Audio/Video:

The Audio/Video submenu contains settings for the playback of audio/video files collected with the current MindWare file

Part 1: Channels



The Channels submenu contains the settings for each channel present in the file. When a MindWare file is first opened, all channels present in the file are enabled for viewing. The following settings are available for each channel in the file:

Channel On/Off: This enables/disables a channel for viewing during file playback. A channel cannot be enabled for viewing if it is not present in the MindWare file.

Note: If a channel is disabled and the MindWare file is saved, the disabled channel's data will not be saved in the new MindWare file.

BioNex Slot: This display indicates the type of data that was collected on the specified channel. This is also the formal name of the channel on the module.

Note: For MindWare files created prior to BioLab 2.4 this information is not available. This field will then read "Not Available" for all files of this type.

View Scale: This button launches the Preview Scaling screen, which allows users to see the affects of various scaling methods on the channel. This screen behaves in the same way as before (see **Section 2: BioLab Configuration Screen**), except the data shown on the displays comes from a file rather than the BioNex.



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Scaling Type: The same scaling types are available as in acquisition mode. Once again, the setting of any scaling type other than “none, default” will result in the launching of the Preview Scaling screen.

Gain: This indicates the gain at which the specified channel was collected.

Note: Gain is not reprogrammable post-acquisition, so this field is disabled in file mode.

Filter Type: This control specifies the filter that will be used on the channel while acquiring data. Each filter has a default Low and High Cutoff associated with it.

Low Cutoff: This control behaves in the same way as in acquisition mode, and must abide by the same rules (see **Section 2: BioLab Configuration**).

High Cutoff: This control behaves in the same way as in acquisition mode, and must abide by the same rules (see **Section 2: BioLab Configuration**).

Note: All files created prior to BioLab 3.0 have data saved with the filters already applied. Changes made to the filter type on these files could potentially result in double-filtering the data, and should be done with care.

Channel Name: This control allows the user to define the channel name. This will be used to identify the channel both on the File Viewer screen and in the MindWare file (if changes are saved).

Waveform Math: This control sets the type of waveform math to be applied to the specified channel during file playback. The same options are available as in acquisition mode.

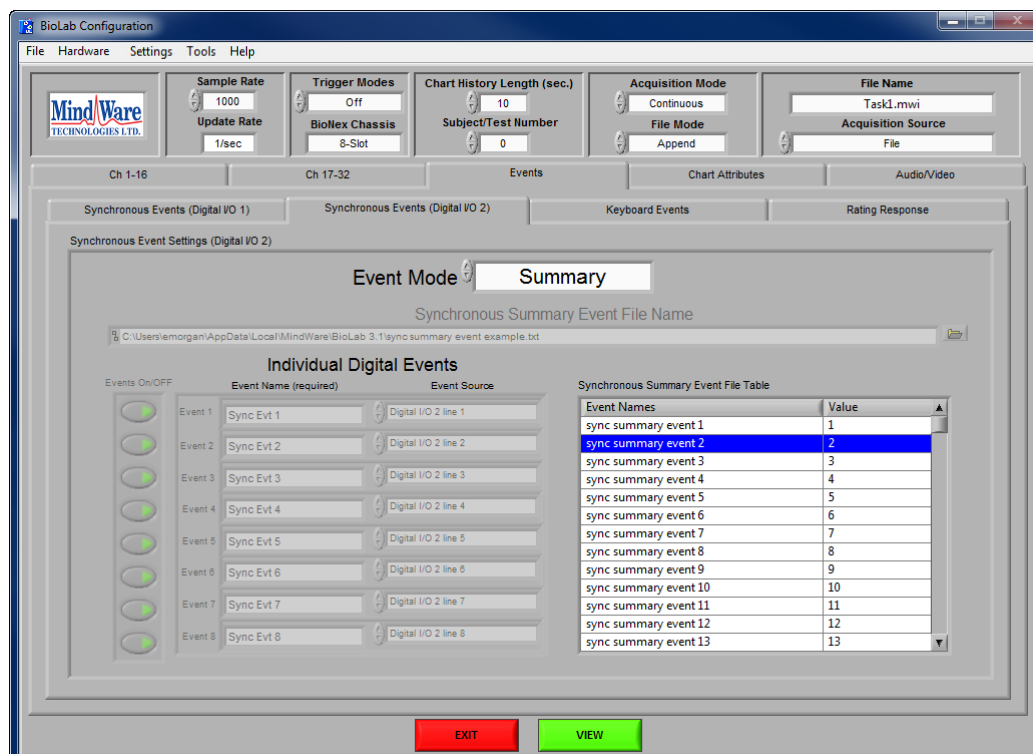
WaveMath Ch Name: Specified the channel that will be added or subtracted from the current channel. All channels present in the file are available for selection from this list. This control will only be enabled if “Add” or “Subtract” waveform math has been selected.

Preview: This button launches the Preview Scaling and Filtering screen, which allows the user to see the effects of various scaling, filtering, and waveform math settings on the specified channel. This screen behaves in the same way as before (see **Section 2: BioLab Configuration Screen**), except the data shown on the displays comes from a file rather than the BioNex.

Part 2: Events

The Events submenu contains settings for synchronous and asynchronous digital event channels present in the file as well as keyboard events that can be inserted during file playback. Within the Events submenu, there are three additional categories: **Synchronous Events**, **Asynchronous Events**, and **Keyboard Events**.

Part 2a: Synchronous Events



The Synchronous Events submenu contains options for configuring the display of synchronous digital event channels present in the MindWare file. The following settings are available:

Event Mode: This control is defaulted to the synchronous digital event mode present in the file. The only options available in file mode are the mode present in the file and Off, which will remove the synchronous event channels from the data display during playback.

Synchronous Summary Event File Name: This display shows the path of the synchronous summary event file used at the time the file was acquired.

Individual Digital Events: These controls are used to define the individual synchronous event channels present in the file.

Events On/Off: Enables/disables a specific digital line for viewing during file playback. If an event channel is not present in the file, it cannot be enabled for viewing.

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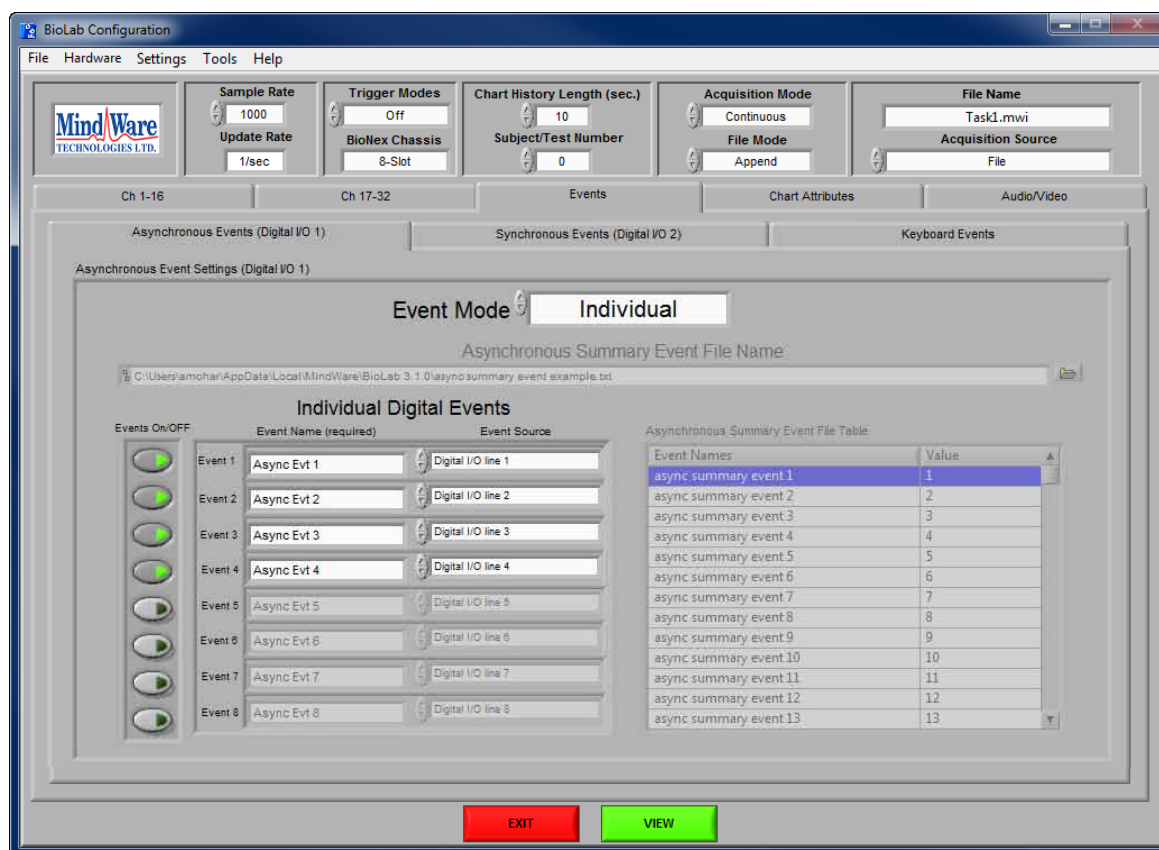
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Event Name (required): This control allows the user to define the digital event name. This will be used to identify the channel both on the File Viewer screen and in the MindWare file (if changes are saved).

Event Source: This display shows the source of the synchronous event channel as defined when the file was acquired.

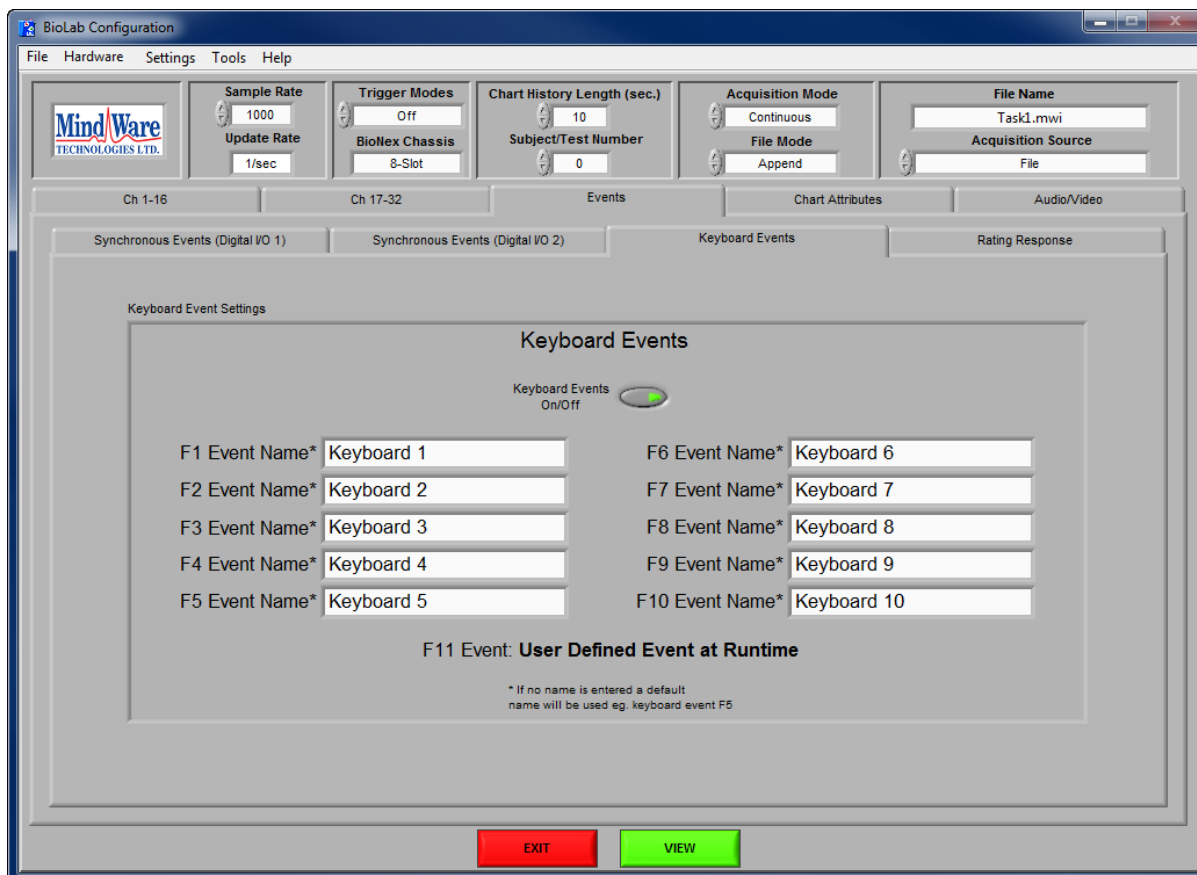
Synchronous Summary Event File Table: This display shows the names of the summary events used when the file was acquired.

Part 2b: Asynchronous Events



The Asynchronous Events sub-menu indicates how the asynchronous event channels were configured when the file was acquired. This sub-menu is merely a display and is **not** editable, as changes made here will have no effect on the file playback (since asynchronous event channels are not saved in the MindWare file).

Part 2c: Keyboard Events



The Keyboard Events submenu contains settings for configuring the keyboard events available to the user during file playback. The settings are initialized to the keyboard event names at the time of acquisition of the current MindWare file. The following settings are available:

Keyboard Events On/Off: This control enables/disables use of keyboard events during file playback.

Keyboard Event Names: These fields describe how the keyboard event will be identified on the File Viewer screen as well as in the Event file saved during file playback. If there is no name specified, a default name will be used based on the key from which the event was detected.

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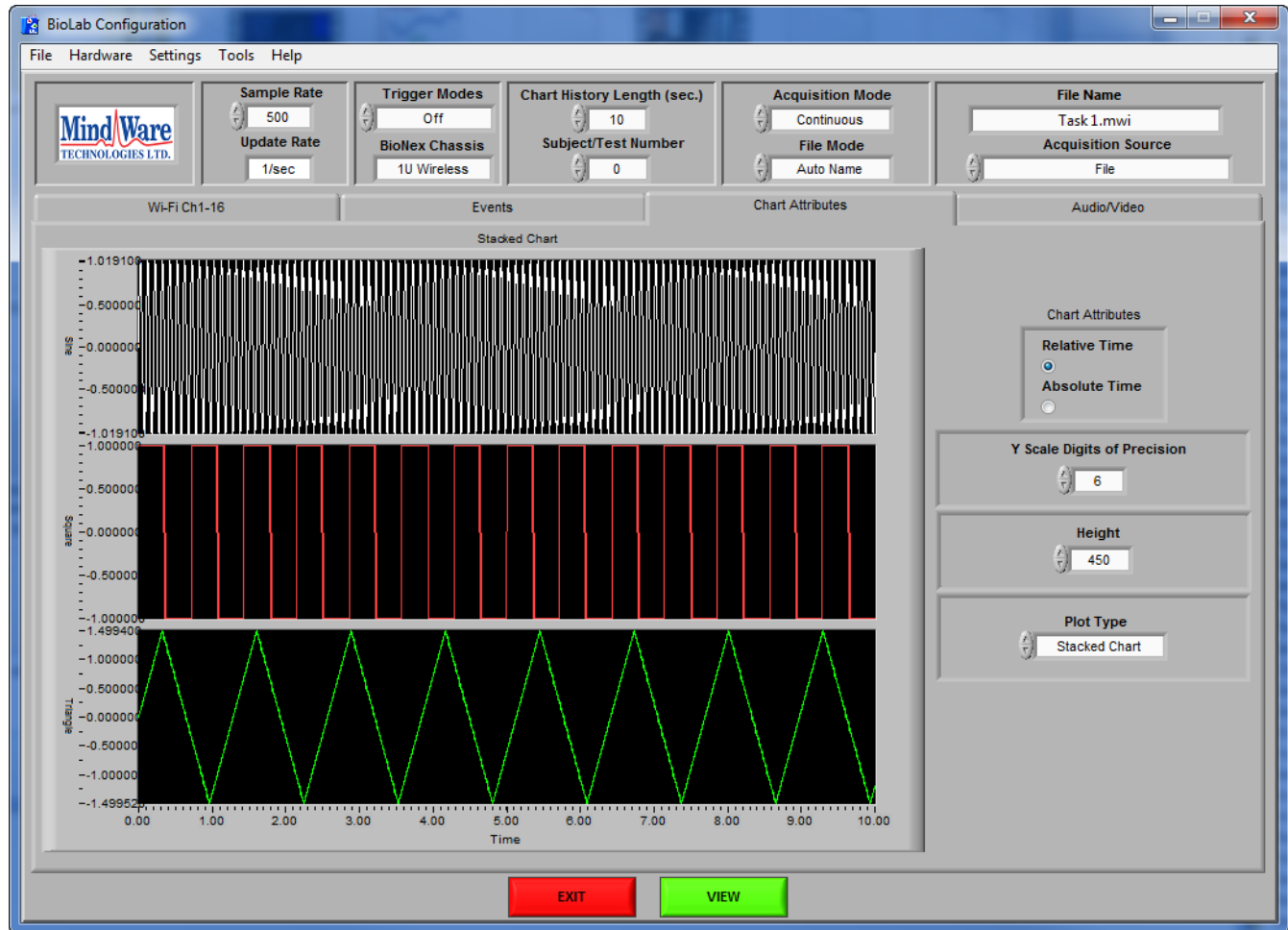
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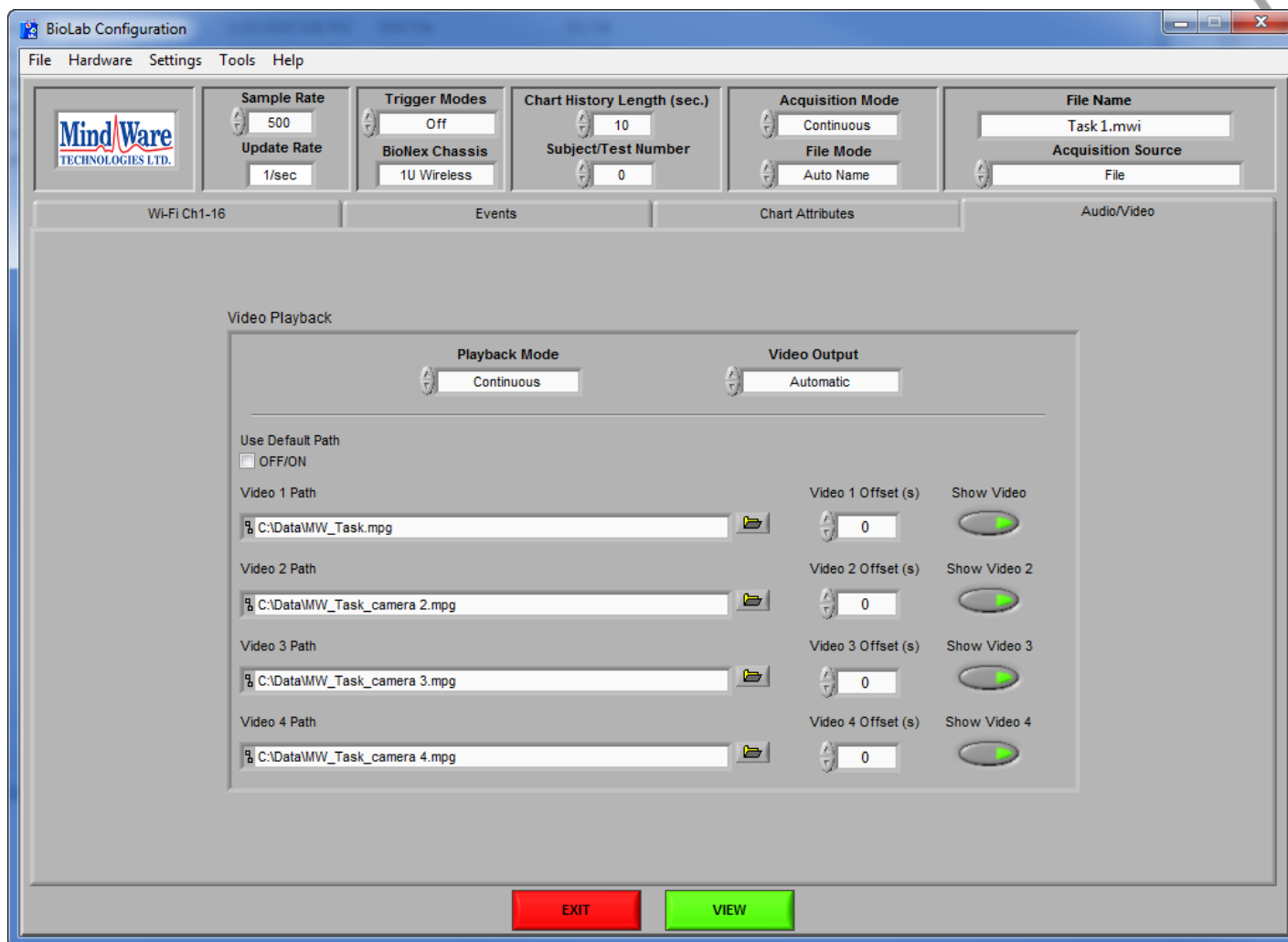
Part 3: Chart Attributes



The Chart Attributes submenu contains settings for adjusting how the data is displayed on the File Viewer screen, and behaves the same as it did in acquisition mode (see **Section 2: BioLab Configuration**) but with the ability to view data in relative (seconds) or absolute (HH:MM:SS) time. The settings are initialized to how they were set at the time of acquisition, but are fully adjustable.

Part 4: Audio / Video

The Audio/Video submenu allows the mapping of audio/video files acquired with the current MindWare file to be played back on the File Viewer screen. Files with the expected default names in the same directory as the current MindWare file are automatically mapped and enabled for playback. The following controls are available for each video:



Use Default Path: When checked, the video file with the expected name will be loaded and played back. Uncheck this box to custom map a video file for playback.

Video Path: This field represents the file path of the specified audio/video file.

Show Video: Enables/disables the specified video file for playback.

Playback Mode: This control specifies the way the file and its associated videos will be played back. There are two playback modes:

Continuous: When the end of the current time segment has been reached, the next segment will be loaded and playback will continue.

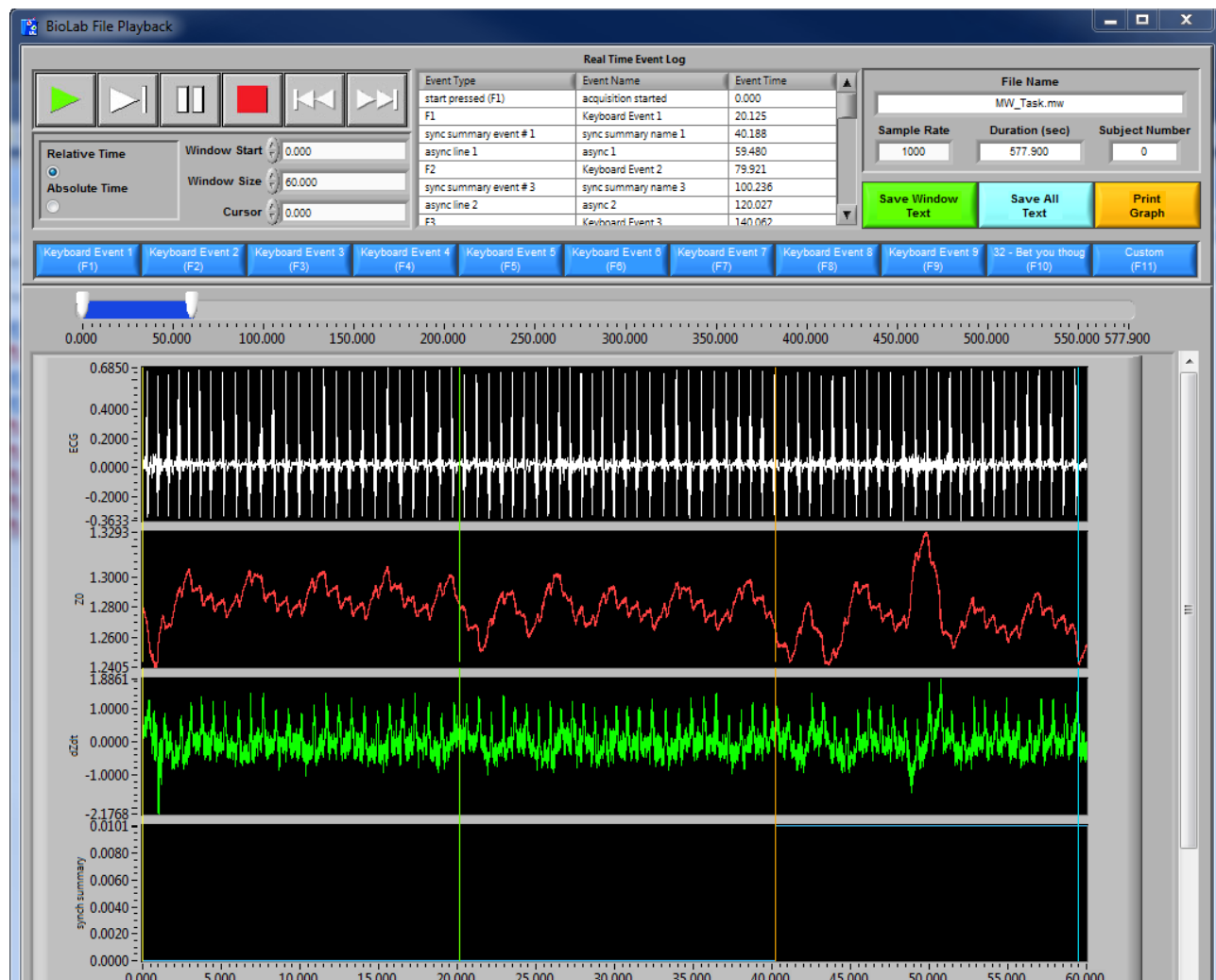
Segmented: When the end of the current time segment has been reached, play back will be paused until user starts it again.

Video Output: Select the graphics system which will be used to render the video. If video playback is poor quality, freezes, or crashes, try switching this setting. All videos mapped on this submenu will appear in a floating resizable window. When multiple videos are present, audio can be toggled between the videos by clicking on the video with desired audio. Once all settings in the BioLab configuration screen have been appropriately set, press the View button below the submenu to proceed to the BioLab File Playback screen. Once all settings in the BioLab configuration screen have been appropriately set, press the **View** button below the submenu to proceed to the BioLab File Playback screen.

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BioLab File Playback



The BioLab File Playback screen is the main file viewing window where file playback can be controlled and post-acquisition event editing can be performed.



Note: During multiple video playback, audio can be toggled from video to video by clicking on the window with desired audio. The video that is currently broadcasting audio will show a speaker symbol in the upper left corner of the window.

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Upon launching the BioLab File Playback screen, any video files which were mapped on the Audio/Video submenu on the BioLab Configuration screen will also appear in a single floating window. This window can be moved and resized separately from the main playback screen.

The data display on the playback screen is where the data from the selected MindWare file is displayed in the format specified on the Chart Attributes submenu of the BioLab Configuration screen. In addition to the data, this display also displays event markers for all events in the corresponding MindWare Event file (Keyboard = Green, Summary = Orange, Individual = Blue) and contains the position cursor (Yellow) which reflects the current file (and video) playback position. The position cursor can be dragged anywhere within the data set, at which point all videos will be updated to reflect this new position.

By right-clicking on the data display, the following options are available from the run time menu:

Autoscale Y: When enabled, y-axis is scaled to show full range of data in window. Otherwise, only shows data between specified values.

Static Analysis: Performs specified static analysis on data within the current window (see **Section 8: Static Analysis**).

The following playback controls are available in the upper left hand corner of the playback screen:

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Play: This control initiates playback of the video at normal speed from the specified location.



Pause: This control pauses playback of the video at the current location.



Stop: This control stops playback and returns to file position to the start of the file in Continuous playback mode, or the beginning of the segment in Segmented playback mode.



Next Segment: Jump forward in time by the specified Window Size



Previous Segment: Jump back in time by the specified Window Size



Slow: This control slows playback of the video to half normal speed.

Time Display: Select whether data is displayed in relative time (seconds) or absolute time (HH:MM:SS).

Note: Absolute time may not be available if you are viewing a .mw file that does not have a corresponding event file

Window Start: Specifies the time at which the current data window starts. Corresponds to the File Position slider

Window Size: The amount of data shown in the current window (maximum 300 seconds). If there is not enough data in the file to fill the requested window size, this control will turn red.

Cursor: The current location of the yellow position cursor.

Save Window Text: This control saves all data currently in view to a tab-delimited text file for use in external applications. Upon pressing this button, the user will be prompted to select a destination and filename for this file.

Save All Text: This control saves all data in the opened MindWare file to a tab-delimited text file for use in external applications. Upon pressing this button, the user will be prompted to select a destination and filename for this file.

Print Graph: This control allows the user to print the current graphical view of the MindWare file to a specified printer.

To the right of the playback controls is the **Real Time Event Log** which lists all events found in the corresponding MindWare Event file. These events are all marked on the data display in the colors specified above.

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Real Time Event Log		
Event Type	Event Name	Event Time
F1	Keyboard Event 1	20.125
sync summary event # 1	sync summary name 1	40.188
async line 1	async 1	59.480
F2	Keyboard Event 2	79.921
sync summary event # 2	sync summary name 2	100.226

By double-clicking on an event listed in this log, the file position is immediately advanced to the time of the selected event. This is very useful for indexing through a file based on event occurrences.

By selecting an event and right-clicking the event log, there is the option of removing the event from the log. When an event is removed from the log, its corresponding event cursor is also removed from the data display. User confirmation is required prior to removing any event from the log.

Beside the Real Time Event Log in the upper right hand corner of the playback screen are the file settings. The following settings are displayed:

File Name: This display shows the name of the currently opened MindWare file.

Sample Rate: This display shows the rate at which the data was collected (in samples per second).

Duration (sec): This display shows the total length of the MindWare file (in seconds).

Subject Number: This display shows the current subject number as specified when the current MindWare file was created.

Keyboard Event 1 (F1)	Keyboard Event 2 (F2)	Keyboard Event 3 (F3)	Keyboard Event 4 (F4)	Keyboard Event 5 (F5)	Keyboard Event 6 (F6)	Keyboard Event 7 (F7)	Keyboard Event 8 (F8)	Keyboard Event 9 (F9)	Keyboard Event 10 (F10)	Custom (F11)
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Below these settings are the Keyboard Event controls. These controls are labeled according to the event names set on the Keyboard Events submenu on the BioLab Configuration screen. These are active buttons which insert the specified keyboard event in the event log when pressed. These buttons can also be activated by pressing the corresponding key on the keyboard.

While a file is being played back, if at any time a keyboard event is detected (whether by pressing a keyboard event control or its corresponding key stroke), a new event of this type will be added at the location of the position cursor. The new event will appear as both a new entry in the event log and an event cursor on the data display.

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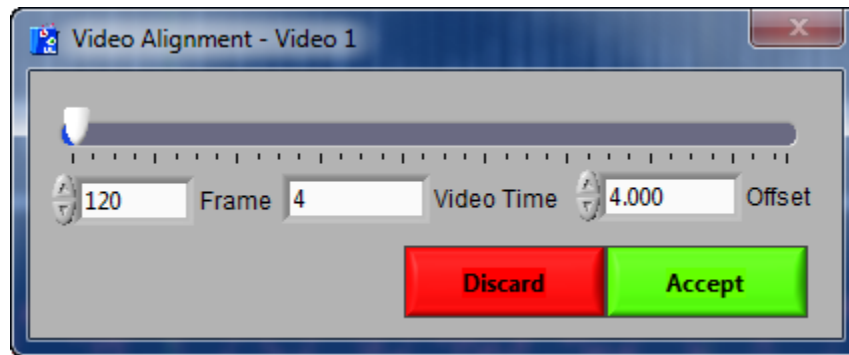
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Just above the data display is the **File Position** slider which sets the start time of the segment of data being viewed. Adjusting this slider will automatically relocate the position cursor to the start of the data window. This slider will be disabled during video playback.



Right-clicking on any video stream will bring up the Video Alignment tool. This will allow you to adjust the current time of a single video relative to the current time of any other videos as well as the physiology in the event that all of these components are not synchronized. The video time can be adjusted by frame, or by seconds. Pressing left and right keys on the keyboard will rewind fast forward the video by a single frame, respectively. These offsets are automatically stored in the User Preferences file for later use in BioLab and the MindWare Analysis applications.

Section 7

Video Playback

When opening a file on the BioLab Configuration screen, a video file (.mpg or .avi) can be selected for playback instead of a MindWare file. If this is done, the BioLab Configuration is configured for Video Playback.

Note: When selecting a video for playback which has additional videos associated with it (multiple cameras) select the video from the first camera for playback and BioLab will automatically recognize the associated videos and map them for playback as well.



Only the Audio/Video submenu is available when a video file is opened for playback. All videos associated with the selected video file are automatically mapped and enabled for playback. This submenu behaves in the same way as in File Playback mode, with the exception that the **Playback Mode** control is fixed to continuous mode.

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Pressing the **View** button will proceed to the BioLab Video Playback screen.



The BioLab Video Playback screen will show all video together in a single window.

The floating control bar contains all playback controls. Below is the video playback window, which can be moved and resized.

During multiple video playback, audio can be toggled from video to video by clicking on the window with desired audio. The video that is currently broadcasting audio will show a speaker symbol in the upper left corner of the window.

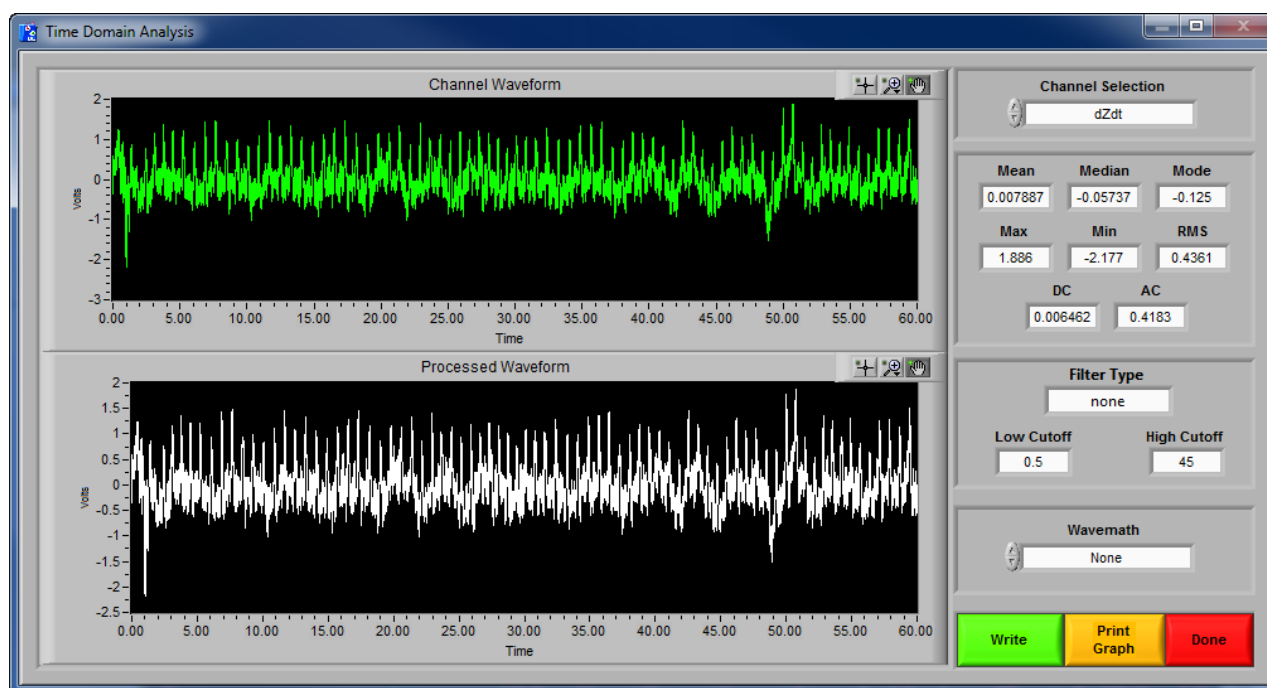
Right-clicking on any video stream will bring up the Video Alignment tool. This will allow you to adjust the current time of a single video relative to the current time of any other videos as well as the physiology in the event that all of these components are not synchronized. The video time can be adjusted by frame, or by seconds. Pressing left and right keys on the keyboard will rewind fast forward the video by a single frame, respectively. These offsets are automatically stored in the User Preferences file for later use in BioLab and the MindWare Analysis applications.

Section 8

Static Analysis

Static analysis can be performed on any signal being acquired or viewed by right clicking on the data display and selecting the desired type of analysis. There are three types of static analysis available: Time Domain, Frequency Domain, and Peak Detection.

Part 1: Time Domain



Time domain static analysis allows for various filters and wavemath to be done to the available signals. Two displays are shown on this screen:

Channel Waveform: This display shows the channel data as shown on the original display. The graph palette is available in the upper right hand corner of the display.

Processed Waveform: This display shows the channel data after the selected filters and wavemath have been applied to it. The graph palette is available in the upper right hand corner of the display.

In the upper right hand corner, the **Channel Selection** control allows the user to switch between all available channels for static analysis.

Note: Changing the Channel Selection control will result in the Filter and Wavemath controls resetting to default.



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Below the **Channel Selection** control are the basic statistics. The **Mean, Median, Mode, Max, Min, RMS, DC Component**, and **AC Component** are all derived from the processed waveform.

The following waveform processing controls are available below the calculated statistics:

Filter Type: This indicator shows the currently applied filter.

Low Cutoff: This indicator shows the low cutoff of the currently applied filter.

High Cutoff: This indicator shows the high cutoff of the currently applied filter.

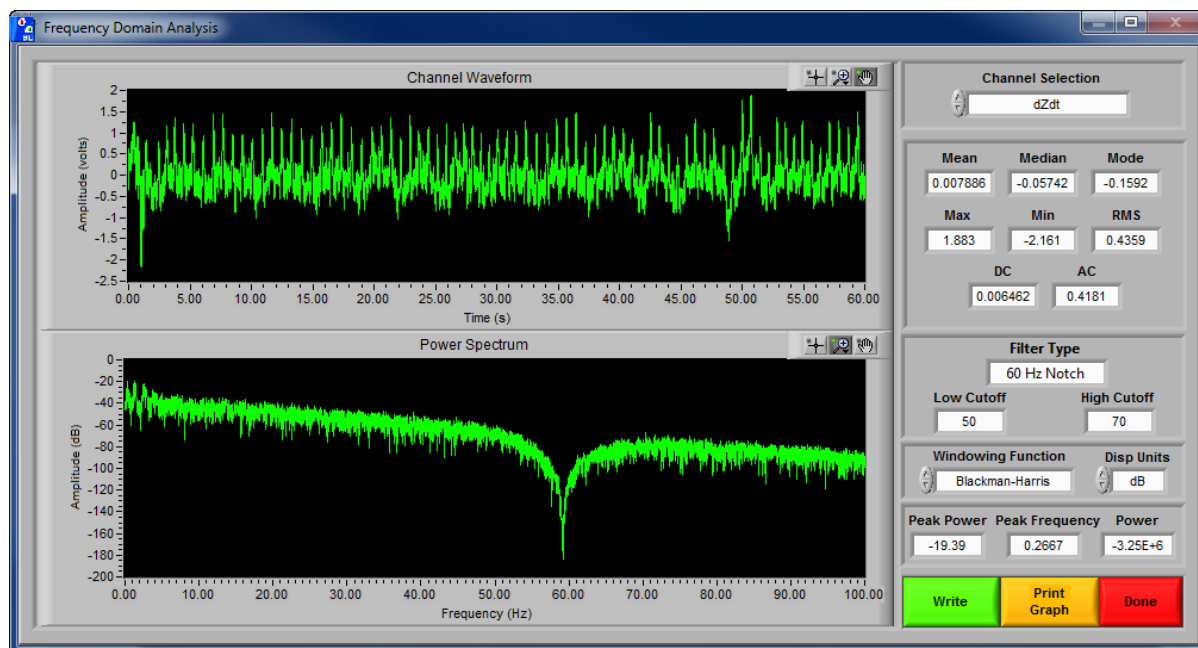
Wavemath: This control applies the specified wavemath to the channel waveform. The wavemath options available are None, Integrate, and Differentiate.

Write: Pressing this button will prompt the user to specify a location for the output file. Upon choosing a destination, the calculated statistics along with current file information will be written to the file.

Print Graph: Pressing this button will print both display graphs along with the calculated statistics using the specified printer.

Done: Exits the Time Domain Analysis window.

Part 2: Frequency Domain



Frequency domain static analysis allows for various filters to be applied to a signal after applying an FFT (Fourier Fast Transform) to the specified channel waveform. This is very useful in determining the effect of noise on different frequency bands on the original signal. There are two display plots shown:

Channel Waveform: This display shows the channel data as shown on the original display. The graph palette is available in the upper right hand corner of the display.

Power Spectrum: This display shows the channel data after the selected filters and FFT have been applied to it. The graph palette is available in the upper right hand corner of the display. This graph is either displayed in Volts (V) or Decibels (dB) versus Frequency (Hz).

In the upper right hand corner, the **Channel Selection** control allows the user to switch between all available channels for static analysis.

Below the **Channel Selection** control are the basic statistics. The **Mean, Median, Mode, Max, Min, RMS, DC Component, and AC Component** are all derived from the power spectrum.



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In addition to the basic statistics, the following statistics are also calculated, and are listed below the waveform processing controls:

Peak Power: This displays the measured peak power from the power spectrum waveform.

Peak Frequency: This displays the measured frequency with the highest amplitude from the power spectrum waveform.

Power: This displays the overall power as derived from the power spectrum waveform.

*Note: These values will be displayed in volts (V) or decibels (dB) depending on the selection of the **Disp Units** control.*

The following waveform processing controls are available:

Filter Type: This indicator shows the currently applied filter.

Low Cutoff: This indicator shows the low cutoff of the currently applied filter.

High Cutoff: This indicator shows the high cutoff of the currently applied filter.

Windowing Function: This control specifies the window to use when applying the FFT to the channel waveform.

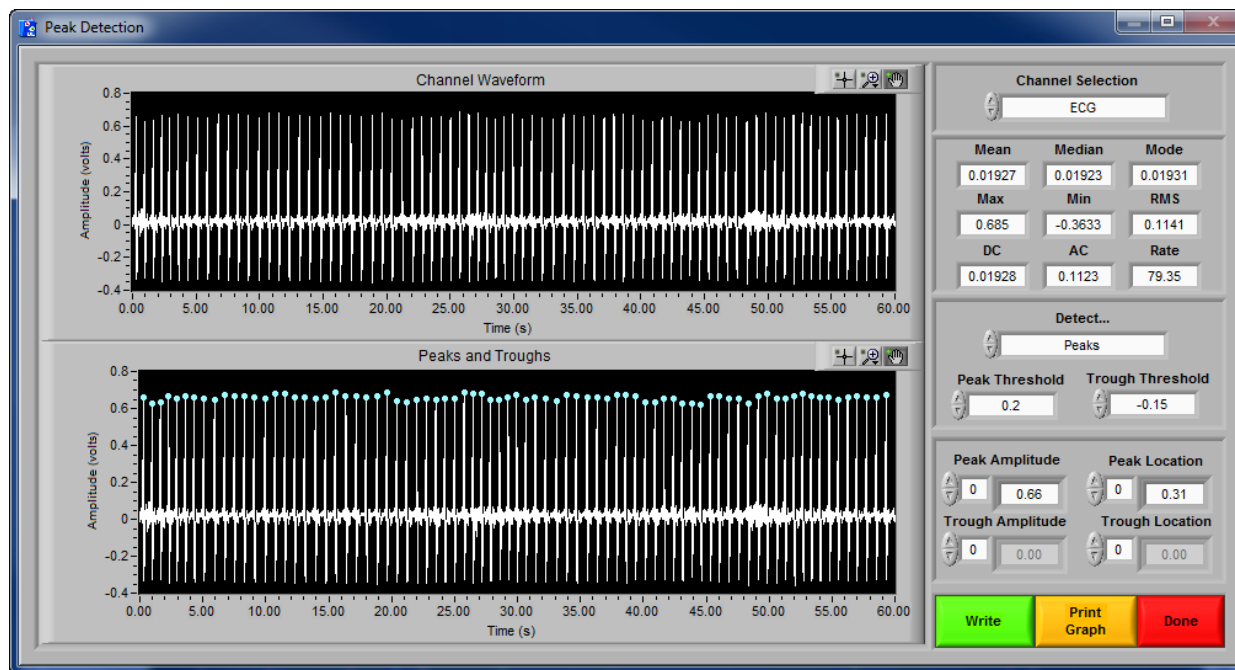
Disp Units: This control specifies the units to display the power spectrum in. **Linear** displays the spectrum in volts, while **dB** displays the spectrum in decibels.

Write: Pressing this button will prompt the user to specify a location for the output file. Upon choosing a destination, the calculated statistics along with current file information will be written to the file.

Print Graph: Pressing this button will print both display graphs along with the calculated statistics using the specified printer.

Done: Exits the Frequency Domain Analysis window.

Part 3: Peak Detection



The Peak Detection window allows for peaks and troughs of the specified waveform to be detected and labeled. There are two display plots shown:

Channel Waveform: This display shows the channel data as shown on the original display. The graph palette is available in the upper right hand corner of the display.

Peaks and Troughs: This display shows the channel data with peaks and troughs marked with cursors (blue = peak, green = trough).

In the upper right hand corner, the **Channel Selection** control allows the user to switch between all available channels for static analysis.

Below the Channel Selection control are the basic statistics. The **Mean, Median, Mode, Max, Min, RMS, DC Component, and AC Component** are all derived from the channel waveform.

Along with the basic statistics, the following statistics are also calculated:

Peak Amplitude: This indicator lists the amplitude of each detected peak.

Peak Location: This indicator lists the location in time of each detected peak.



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Trough Amplitude: This indicator lists the amplitude of each detected trough.

Trough Location: This indicator lists the location in time of each detected trough.

The following Peak Detection settings are available:

Detect...: This control specifies whether to detect peaks, troughs, or both.

Peak Threshold: This control specifies the minimum amplitude of a detected peak. If invalid peaks are being detected, try increasing this value until only valid peaks appear on the Peaks and Troughs display.

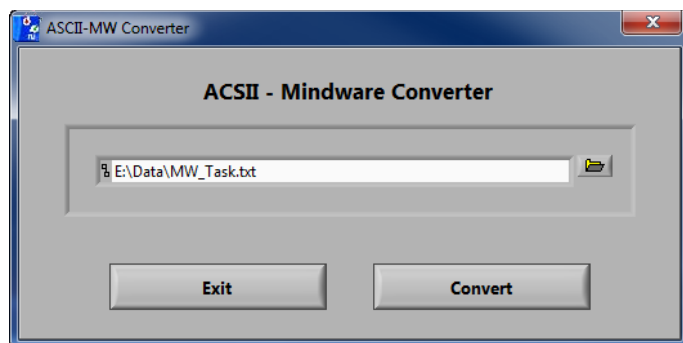
Trough Threshold: This control specifies the maximum amplitude of a detected trough. If invalid troughs are being detected, try increasing this value until only valid troughs appear on the Peaks and Troughs display.

Write: Pressing this button will prompt the user to specify a location for the output file. Upon choosing a destination, the calculated statistics along with current file information will be written to the file.

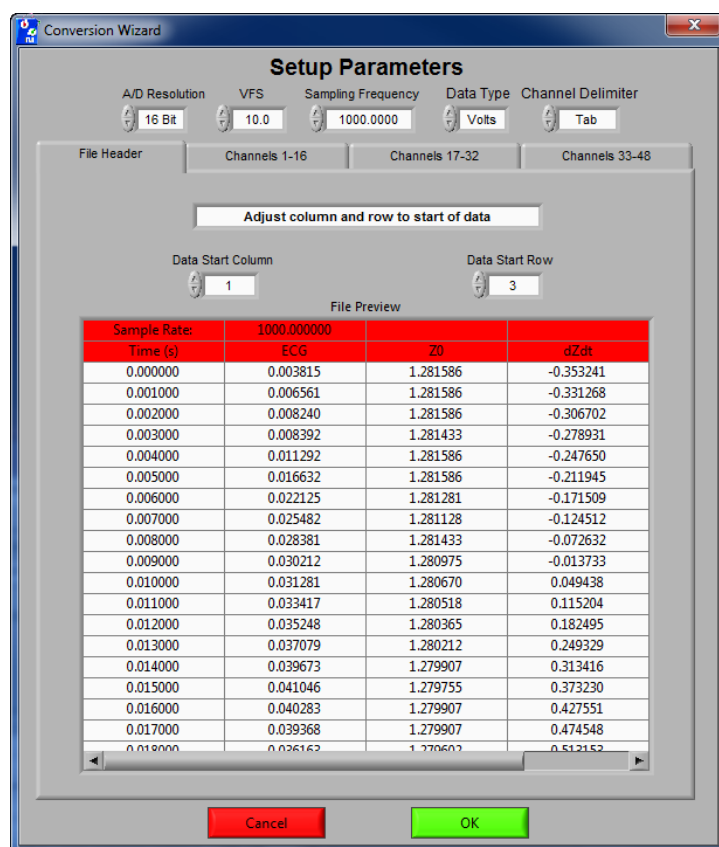
Print Graph: Pressing this button will print both display graphs along with the calculated statistics using the specified printer.

Done: Exits the Peak Detection window.

Appendix A: ASCII-MW Converter



The ASCII-MW Converter allows the conversion of any text file containing data in some character-delimited columns to the .mw format so that it may be used in any analysis application. To begin conversion, select a text file containing data by using the browse button on the file path control and pressing Convert. To exit the converter and return to the setup screen, press Exit.



The next screen in the conversion process is the Text File Conversion Wizard. From this screen, details about the data in the text file must be entered in order to properly scale and display the data in the analysis applications. It is extremely important that these values are identical to the way the data was acquired to ensure the correct conversion.

A/D Resolution: This control is the resolution of the A/d converters in the hardware used to acquire the data in the file.

VF_s: This control is the volts full scale of the hardware used to acquire the data in the file.

Sampling Frequency (Hz): This control is the sampling frequency at which the data in the file was collected.

Data Type: This control specifies whether the data in the file is in volts or A/d counts.

Channel Delimiter: This control specifies the character which is used to separate data channels in the file.

Below these settings is the submenu control. The following submenus are available:

File Header: This submenu contains a preview of the beginning of the selected text file. Using the controls **Data Start Column** and **Data Start Row**, select where the data actually begins in the file past any file header information. Rows and columns which will not be included in conversion appear in red.

Channels 1-16: This submenu contains the channels found in the text file and allows for them to be selected/deselected for conversion.



The following controls are available:

Channel Names: This control allows the user to specify a name for the data channel to be saved in the .mw file header.

Scaling Type: This control specifies whether the data in the file is scaled or unscaled. If the data is scaled, the Scale Factor and Offset fields will be enabled for modification.

Scale Factor: If the data in the specified channel is scaled, this control represents the factor by which it is scaled.

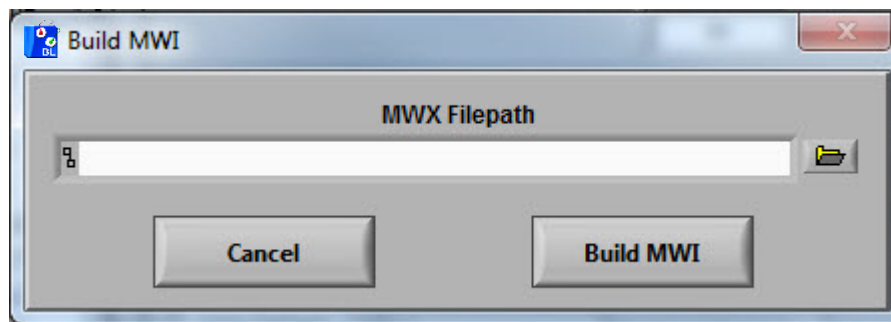
Offset: This control represents the offset of the scaled data channel.

Submenus **Channels 17-32** and **Channels 33-48** behave in the same way.

Pressing OK will convert the file to the .mw format (may take several minutes depending on size of data file) and return to the Setup screen. Pressing cancel will return to the file selection window.

Appendix B: Build MWI

The Build MWI tool created an MWI file for a specified MWX file. When an MWX file is created without an MWI file (such as in local mode of Mobile Recording), an MWI file will need to be created before that file can be analyzed.



Appendix C: Software Upgrade

BioLab will automatically check for new versions of the application on startup. To manually check for updates you can go to Help>>Check for Updates.

It is recommended to keep this feature enabled to ensure the latest version of the application is always being used. However, automatic checking for updates can be disabled on the update notification window.



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