MindWare Blood Pressure Variability (BPV) Analysis
User Reference Guide
Version 3.0.12

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Table of Contents

1020-F Taylor Station Rd. Gahanna, OH 43230

Section 1: Channel Mapping

Upon opening the BPV analysis application, the user will be prompted to select a file for analysis. Once this file is selected, press OK to proceed to the channel mapping screen.

The Map MindWare Channels to Channel Type screen allows the user to identify the physiological data type for each channel in the data file using a pull down list. The list is derived from the header of the input file.

Although each data type in the file can be defined, not all channels must be assigned a specific data type. For BPV analysis, dZ/dt or Z0 or Respiration, BP, and Trigger Channels (if applicable) need to be selected. Any channel defined other than these types will be ignored in BPV analysis.

File: This indicator displays the path and name of the file under analysis.

Channel Labels: This indicator displays the names of the channels as read from the file header of the input file.

Channel Types: These controls allow the user to assign a channel name from File Header Channel Names to a specific data type. For basic BPV analysis, only the BP channel is required. The trigger channel must be defined for any of the event-based analysis modes. Either Zo, dZ/dt, or Resp channel must be mapped for respiration and Baroreflex calculations.

Total Time(s): This indicator displays the total time as read from the input file (in seconds.)

Sampling Frequency (Hz): This indicator displays the Sampling Frequency as read from the input file.

Application Name: This indicator displays the analysis application that is currently running.

Use BioLab Event File: This control allows the user to specify whether to use the event file created by BioLab in the event-based analysis rather than the trigger channel.

Once the desired channels have been mapped, press OK to continue to the Setup screen.

Section 2: Setup
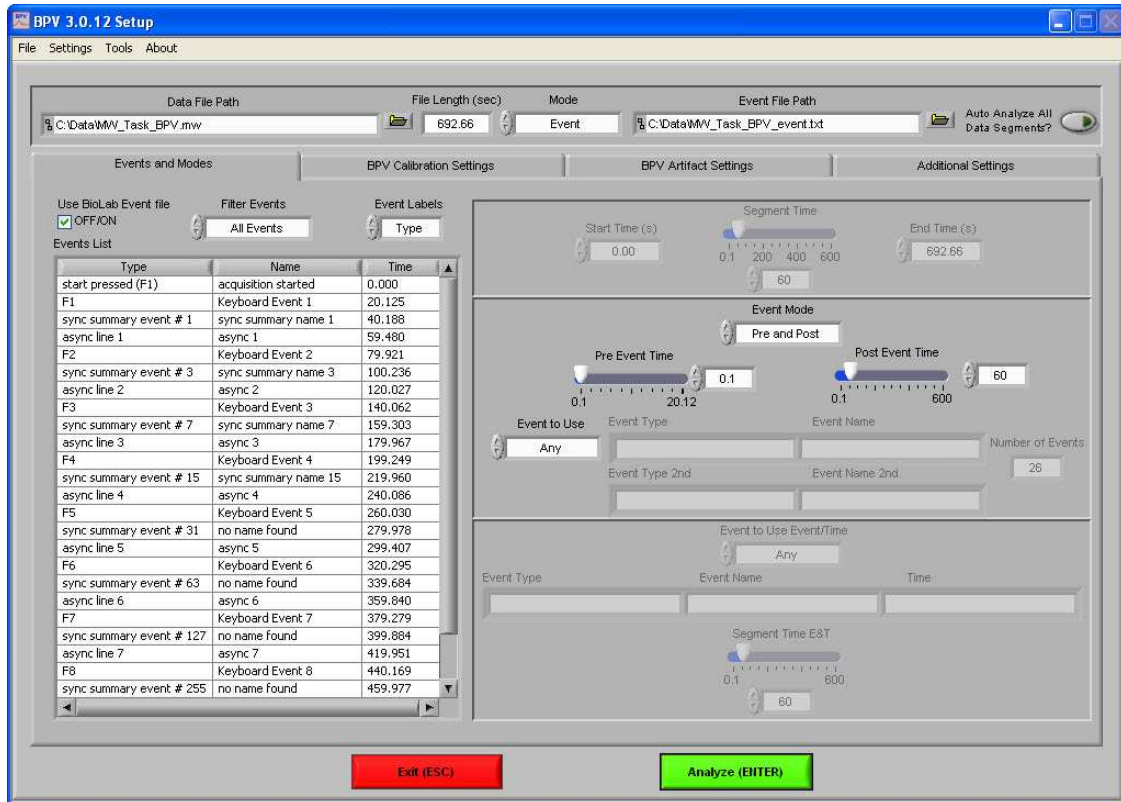
The Setup screen contains many options pertaining to the way in which the analysis is performed.

Data File Path: This control shows the current file selected for analysis. Also, by clicking the browse button a new file may be selected for analysis.

File Length(s): This indicator shows the total file length in seconds.

Mode: This control allows the user to select one of three analysis modes: Time, Event, and Event and Time. The value of this control determines which controls are enabled on the Events and Modes tab.

Event File Path: If a BioLab event file is being used for analysis, the path of that event file is shown in this indicator.

Auto Analyze All Data Segments: When this control is activated, the application will automatically analyze each segment of the dataset and output it to the specified location.

All changes to settings in the Setup screen are saved to a configuration file automatically whenever analysis is initiated or the application is exited.

The following options are available from the menu bar:

File:

> **Re-Map Channels:** This option opens the Map MindWare Channels to Channel Type screen for modifications to be made to the channel map.
>
> **Scaling and Filtering Settings:** This option brings up a window detailing the scaling and filtering information as it was applied to the channels during acquisition.
>
> **Show Summary Screen:** This option enables/disables the summary screen popup before analysis is started.
>
> **Exit:** This option exits the analysis application.

Settings:

> **Open Configuration:** Allows a previously saved configuration file to be opened.
>
> **Save Configuration As:** This option saves all current settings in the Setup screen to a configuration file which can later be recalled.
>
> **Reinitialize All to Default:** This option will return all settings in the setup screen to factory default.

Tools:

> **ASCII-MW Converter:** Opens the ASCII-MW converter (see Appendix A).

About:

> **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

1020-F Taylor Station Rd. Gahanna, OH 43230

The first tab on the screen, titled Events and Modes, allows the user to select one of the many modes available to use to index through the dataset.

The left side of the screen shows all events in the file either from Trigger channel or the BioLab event file with the event name, type, and time. There are three controls for specifying the way in which the events are viewed:

Use BioLab Event File: When checked, the events displayed are from the BioLab event file. Otherwise, they are detected in the channel mapped as Trigger.

Filter Events: The events shown in the list and used for analysis can be filtered by type to use summary events, keyboard events, individual events, or all events.

Event Labels: This control specifies how the event will be labeled when it is shown in the analysis window.

Time Mode: In time mode, the following parameters are available:

> **Start Time:** Used to set the time at which the first analysis segment will start
>
> **Segment Time:** Specifies the length of each segment, starting at the start time and splitting the remainder of the file into equal length segments
>
> **End Time:** Used to set time at which the last analysis segment will end.

Event Mode: The list to the left of the event controls displays all of the events detected in either the BioLab Event File or the channel mapped to "Trigger". This can be changed by either marking or unmarking the box named "Use BioLab Event File" above the event list. This list can be filtered by type, including Keyboard, Individual, Summary, or All Events. Also, the type of label which will be displayed on the event during analysis can be set by using the "Event Labels" control.

There are 4 viewing modes available in event mode:

> **Pre Event:** The Pre-Event Time slider specifies the number length of the data before the specified event that is included in the segment.
>
> **Post Event:** The Post-Event Time slider specifies the length of the data after the specified event that is included in the segment.
>
> **Pre and Post:** This is a combination of the previous 2 modes in which both the length of the data before and after a specified event can be set.

Event to Event: In this mode, the length of the segment is defined by the time in between the current event and the next event in the list.

For each of these event modes, there is the option of either using any event in the list or specifying a certain event to view. A specific event can be chosen from the event list by first selecting "User Defined" in the Event to Use box, and then selecting the desired event from the list and dragging it to the box labeled "Event Type". In Event to Event mode, two specific events to go between can be selected. The number of events box shows the total number of events of the specified type which will be shown during analysis.

Event and Time: Event and Time mode combines the previous two modes to allow the selection of a specific event to use as a starting point and then to proceed through analysis in time mode from that point. The following parameters are available:

Event to Use Event/Time: This has a similar functionality as in Event mode, where "Any" will simply use whichever event is next in the list and proceed from that point and "User Defined" will proceed in time mode from the location of the specified event. The event can be specified by selecting the desired event in the event list and dragging it to the box below.

Segment Time E&T: Specifies the length of each segment, starting at the location of the specified event and splitting the remainder of the file into equal length segments

1020-F Taylor Station Rd. Gahanna, OH 43230

BPV Calibration Settings

The second tab on the screen, titled BPV Calibration Settings, allows the user to scale the BP signal, define a respiration source, set the filter bands and windowing method, define a calculation method, and define parameters for detecting a baroreflex event.
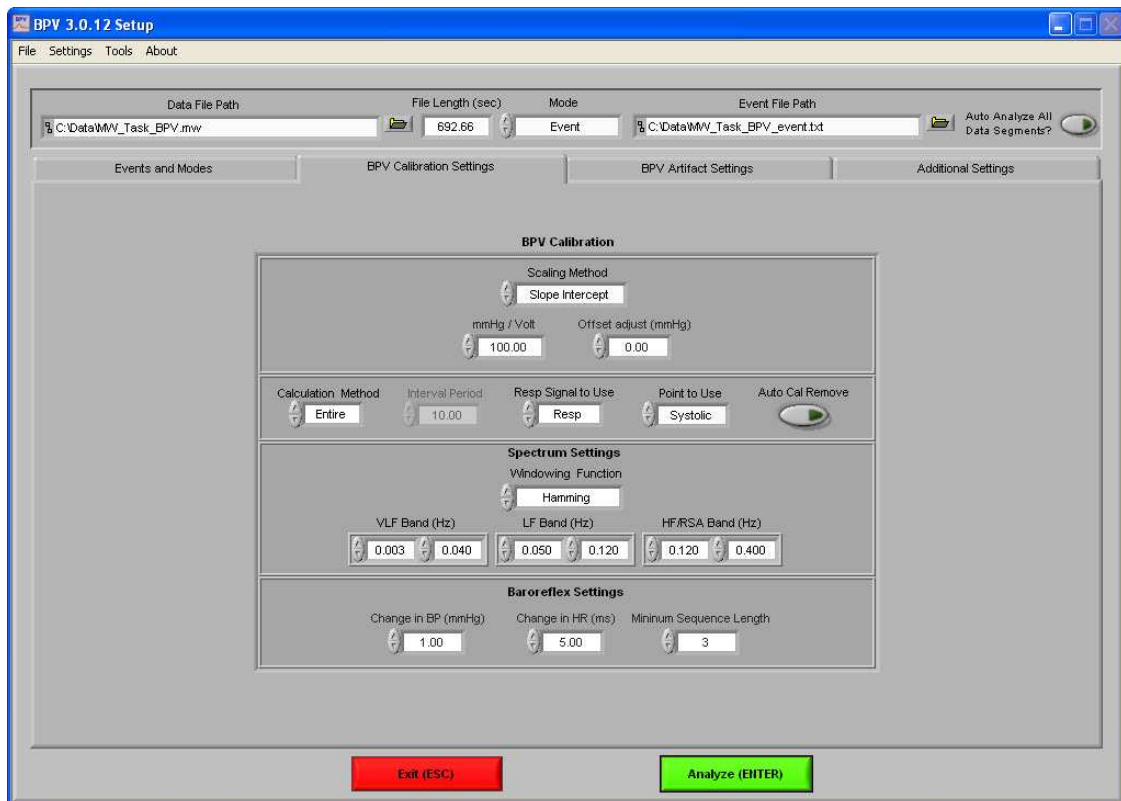
Scaling Method: There are 2 available scaling methods:

> **Slope Intercept:** This mode scales the signal to scaled units using y=m * x + b, where *m* is mmHg/Volt and *b* is Offset Adjust (mmHg).

> **Map Ranges:** This mode maps the voltage range to the scaled units using the Volts Min/Max and mmHg Min/Max controls.

Volts Max: This control sets the maximum voltage of the signal in Map Ranges scaling method.

Volts Min: This control sets the minimum voltage of the signal in Map Ranges scaling method.

mmHg Max: This control sets the maximum range mmHg in the Map Ranges scaling method.

mmHg Min: This control sets the minimum range mmHg in the Map Ranges scaling method.

mmHg/Volt: This control represents the ratio of mmHg to Volts from the blood pressure device in the Slope Intercept scaling method.

Offset Adjust (mmHg): This control represents the offset of mmHg from the blood pressure device in the Slope Intercept scaling method.

Respiration Signal to Use: This control selects the source to use to derive respiration measures. The options available are Resp, dZ/dt, Zo or none.

Calculation Method: This control defines the mode for which the mean heart rate and IBI will be determined. There are two selections available: Entire and Interval. In Entire mode, mean heart rate and mean IBI will be the mean across the total window period defined in the Events and Modes tab. In Interval mode, the window period will be the same as in the Entire mode however these measures are divided into fixed time bins as set by the Interval Period and will represent the mean heart rate and mean IBI values in these intervals.

Interval Period: This control specifies the length of each interval in seconds. (Only applies when interval mode is selected)

Point to Use: This control specifies whether to use systolic or diastolic points in deriving the BP time series.

Auto Cal Remove: When this control is activated, the data collected during the calibration of the blood pressure device will be ignored when calculating BPV stats.

Window Function: This control allows the user to select the type of windowing used before doing the power spectrum calculation to reduce spectral leakage.

VLF Band (Hz): This control sets the VLF frequency cutoffs for filtering the heart period, blood pressure, and respiration time series.

LF Band (Hz): This control sets the LF frequency cutoffs for filtering the heart period, blood pressure, and respiration time series.

HF/RSA Band (Hz): This control sets the HF/RSA frequency cutoffs for filtering the heart period, blood pressure, and respiration time series.

Change in BP (mmHg): This control specifies the minimum change in blood pressure (in mmHg) that represents a baroreflex event.
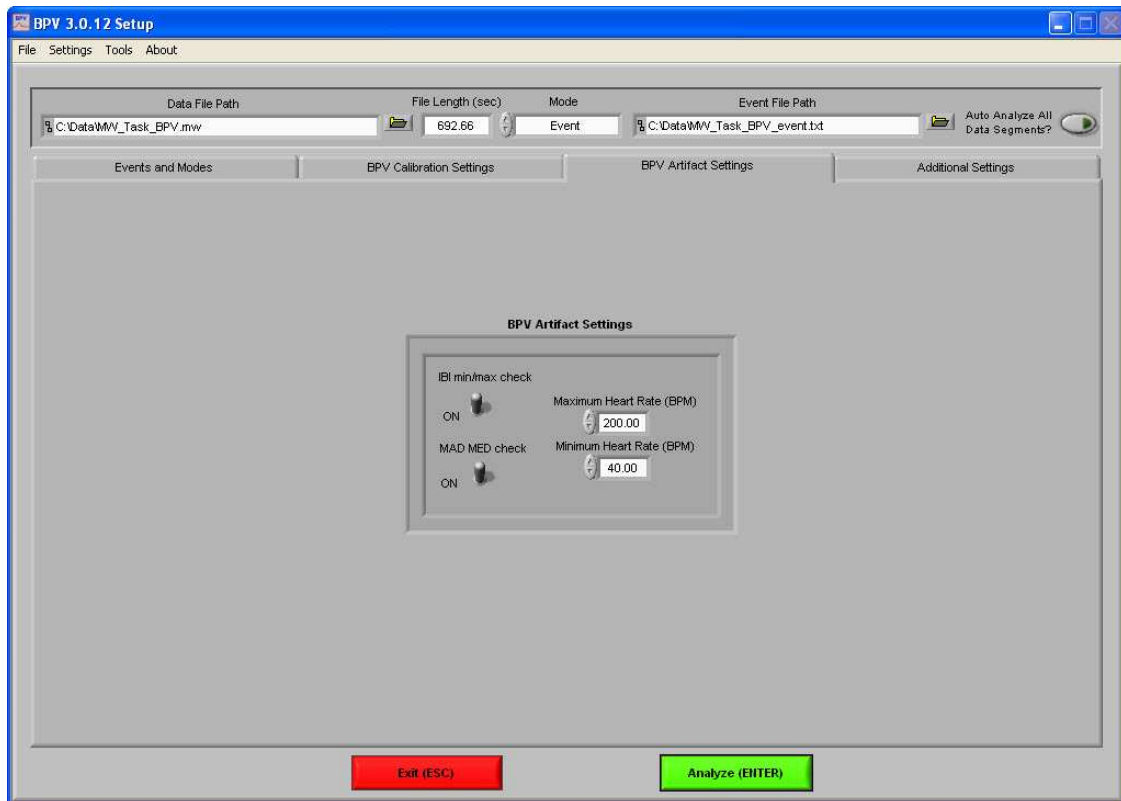
Change in HR (ms): This control specifies the minimum change in heart rate (in ms) that represents a baroreflex event.

Minimum Sequence Length: This control specifies the minimum consecutive changes in both blood pressure and heart rate that must occur to represent a baroreflex event.

BPV Artifact Settings

The third tab on the screen, titled BPV Artifact Settings, allows the user to enable or disable the MAD/MED or IBI min/max heart beat detection methods and set the expected heart rate range.

MAD/MED Check: This control enables or disables the application of MAD/MED criteria to the heart beat detection.

IBI Min/Max Check: This control enables or disables the application of IBI Min/Max criteria to the heart beat detection. The algorithm will test the IBI series to be in range of the settings selected in the Minimum Heart Rate and Maximum Heart Rate controls.

Minimum Heart Rate (BPM): This control allows for the selection of the minimum expected heart rate in the data series. This value will be the minimum IBI threshold.

Maximum Heart Rate (BPM): This control allows for the selection of the maximum expected heart rate in the data series. This value will be the maximum IBI threshold.

Additional Settings

The last tab on the screen, titled Additional Settings, allows the user to select settings for incorporating video in analysis, the use of edited data, and the type of output file created.
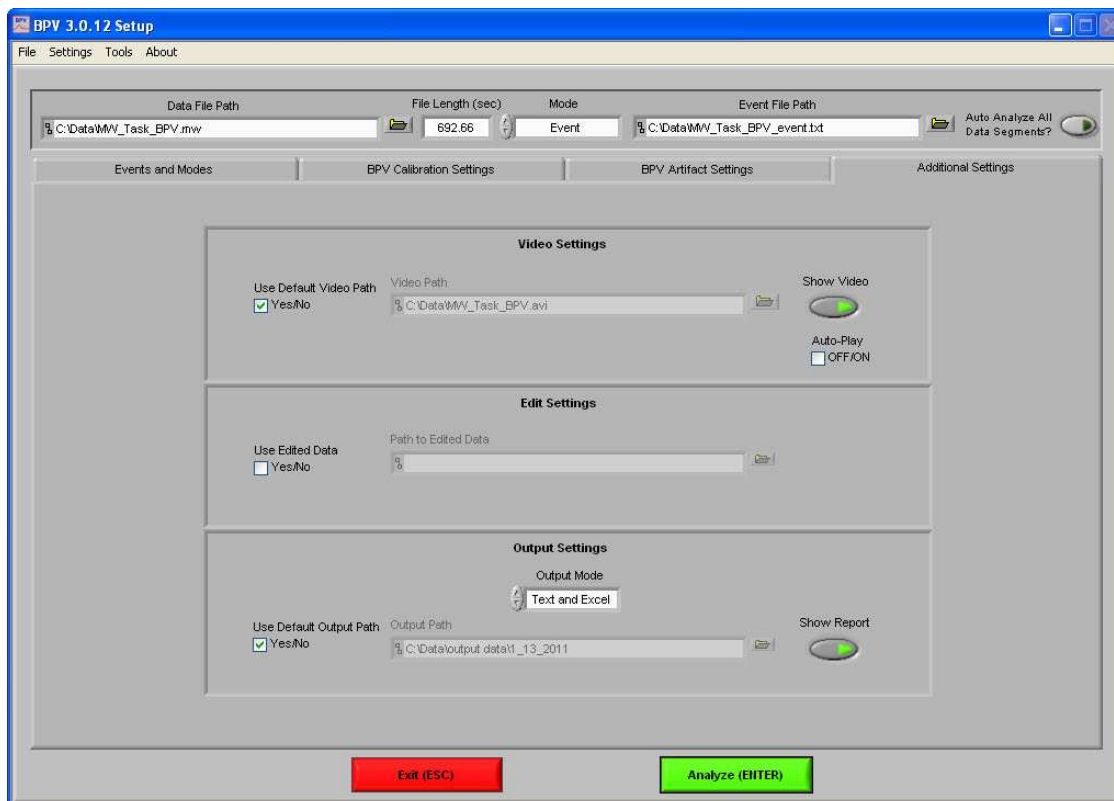
Video Settings: The following parameters are available regarding video playback during analysis:

> **Use Default Video Path:** This selects whether the default video associated with the .mw file will be used, or a video can be specified in its place.

> **Show Video:** Sets whether the video will be shown during analysis or not.

> **Auto-Play:** When this is turned on, the specified video will automatically begin playback when a new segment is selected. Otherwise, the video will not begin playback until it is started by the user.

Edit Settings: If there is edit data associated with the current .mw file, it can be selected here and will be used for analysis. Otherwise, only the data within the .mw file will be used.

Output Settings: The following parameters are available to specify the type and location of the output files:

Output Mode: Either a text file (.txt), an excel spreadsheet (.xls) or both can be output at the end of analysis.

Use Default Output Path: The default output location is a folder named "output data" in the folder which contains the .mw file being analyzed. Within the "output data" folder, files are organized in folders by the date on which they were analyzed. If any of these folders don't exist, they are automatically created when the first output file is written to that directory. A different location to save these files can also be specified in the file box.

Show Report: When turned on, the excel spreadsheet will be opened and written to as the user writes segments to the report. When turned off, the spreadsheet will be written following analysis and saved to the specified directory but never opened.

Section 3: Analysis

When the Analyze button is pressed, if the summary screen has been enabled then the Analysis Summary screen is displayed, showing the various settings from the Setup screen.
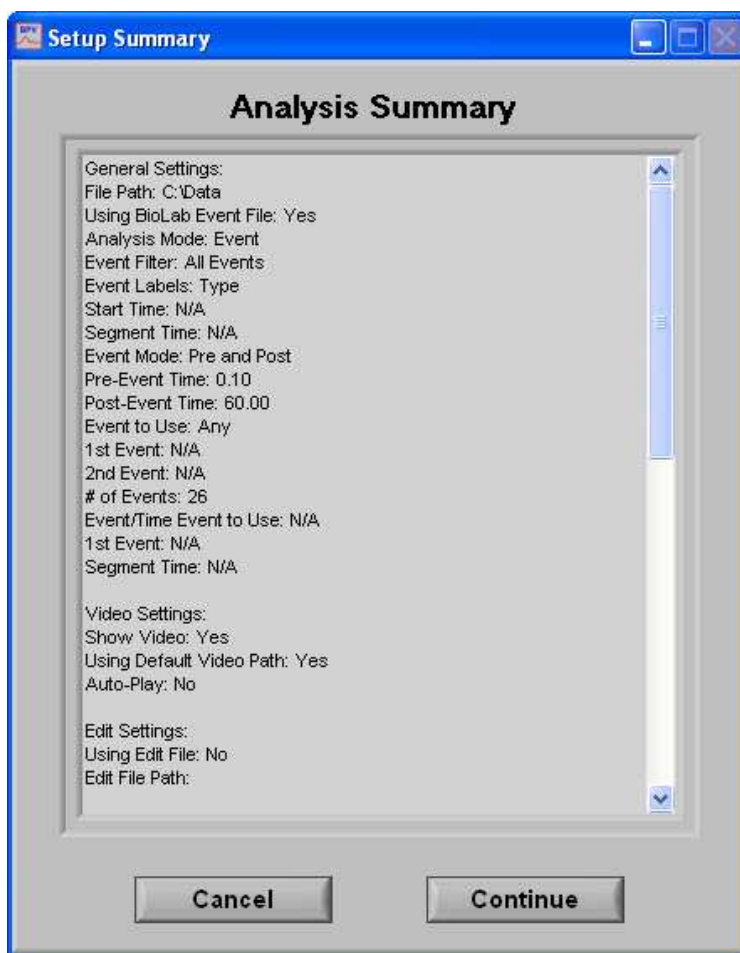

Cancel: This control will return the user to the Setup screen to adjust analysis settings before continuing.

Continue: This control will begin analysis using these settings.

At this point, the user will be shown a segment of data from the channel mapped as BP. The user can then invert the BP signal if required. It is important to have the phase of the BP signal positive for the peak/trough detection to work effectively.
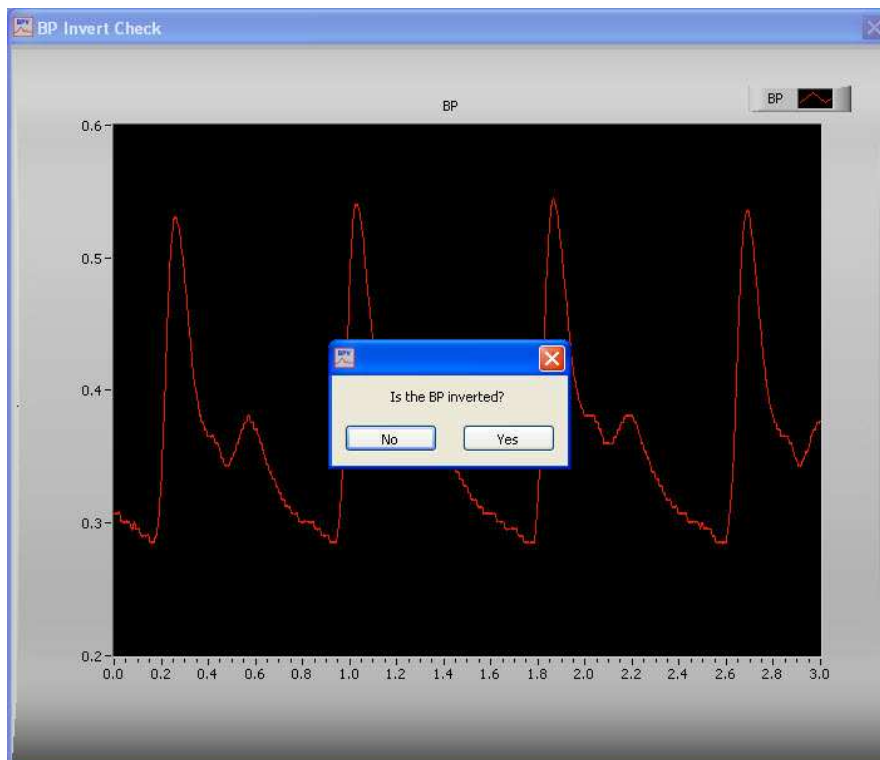
One of the next screens made visible is the Controls screen, which initially sits just above the BPV Analysis window.

The Controls screen is the interface for sequencing through each data segment as well as viewing the program status indicators, editing data, and writing the output file. From here, the user can select the next data segment to analyze, write the statistical information to the output file, or quit to return back to the Setup screen.

1020-F Taylor Station Rd. Gahanna, OH 43230

Current Segment: The Current Segment control allows the user to switch from one data segment to another. Clicking the up/down arrows or clicking the mouse in the selection window can change this value. If the selection window is clicked, all data segments that are available will be displayed depending on the mode criteria in the Setup Screen. Selecting one of these segments will change to that data segment. Pressing the "Page-Up" and "Page-Down" keys allows the user to cycle through the Segments.

File Name: This indicator displays the name of the data file being analyzed.

Write: The Write control is used to write the analysis results for the current segment into the output format specified during setup. This button must be pressed after each segment or the results will not be saved. If data for this segment already exists in the file, it will be overwritten.

Done: This control is used to terminate the current session and return the user to the Setup screen.

Edit Peaks and Troughs: The Edit control switches the window to the graphical editor. The user can insert, delete or move a marker allowing for the correction of any movement artifact or to manually adjust the values as derived by the peak detector. The user is also able to remove data portions.

BPV Artifact: The BPV Artifact control allows the user to modify the values in the BPV Artifact Settings without having to exit this analysis sequence.

Video Settings: The Video Settings control allows the user to modify the video settings from the Setup screen without having to exit this analysis sequence.

Writing: The Writing indicator will be illuminated when the current segment results are being written to the output spreadsheet.
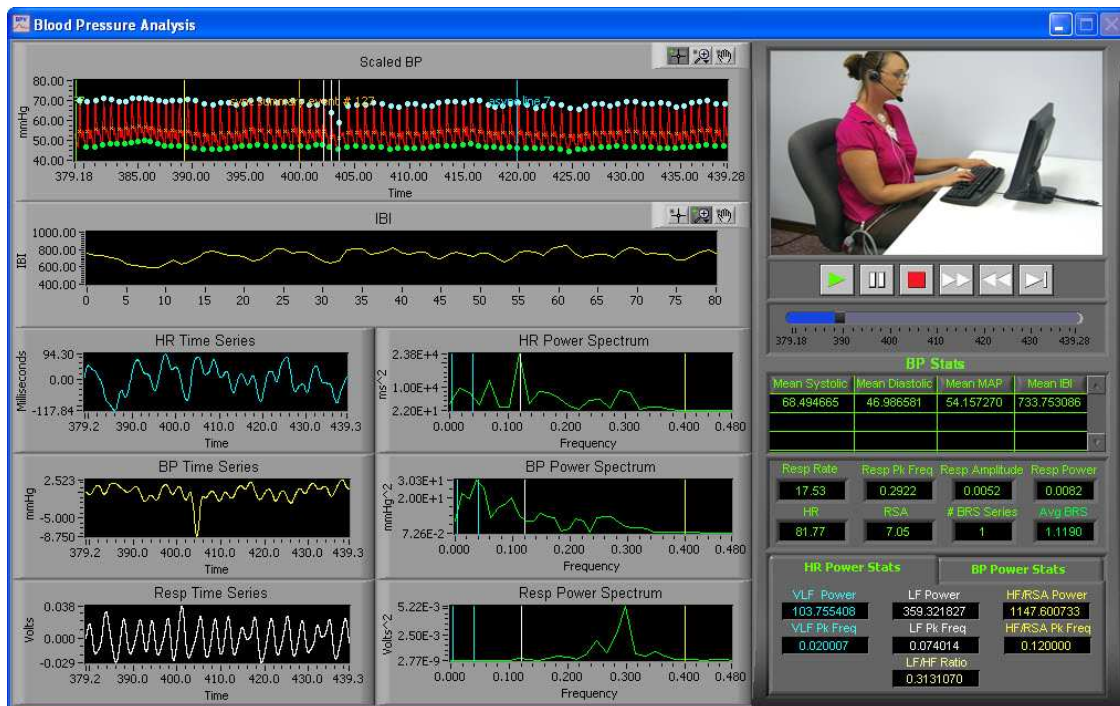
Reading: The Reading indicator will be illuminated when the current data file is being read.

Edit: The Edit indicator will be illuminated when edited data is being used. This will be on when the user exits the editor or is using a previously edited session.

BPV Analysis

The BPV Analysis screen displays the analysis window for the selected data segment.

There are eight plots visible on this screen:

Scaled BP: The values plotted on the Scaled BP window are a beat to beat analog waveform. Peaks are shown as blue points, and troughs are shown as green points. The Mean Arterial Pressure (MAP) is shown as an orange 'X'. Also shown on this plot are the event markers, baroreflex event markers, and the position cursor. The event markers are labeled with either the event name or type (as specified in the Setup screen) and are color coded by type (Keyboard = Green, Summary = Orange, Individual = Blue). The position cursor can be dragged anywhere within the current dataset, at which point the video will be updated to reflect this new position.

Baroreflex events are shown by a sequence of cursors (at least as many as specified by the Minimum Sequence Length control in the Setup screen). Purple represents an ascending BP sequence (and thus descending HR sequence), while white represents a descending BP sequence (and thus ascending HR sequence). By right-clicking the baroreflex event cursors and selecting Show Series Stats from the run-time menu, another small popup window appears displaying detailed stats about the baroreflex event.

Each row of this window represents a point in the BRS series. The heart rate, scaled BP, and time of each point is displayed.

IBI: The values plotted in this window are the IBI Time Series of Scaled BP.

HR Time Series: The values plotted in this window are the IBI series sampled in milliseconds.

HR Power Spectrum: The values plotted in this window are the spectral output of the Heart Period Time Series.

BP Time Series: The values plotted in this window are the time series of Scaled BP sampled in milliseconds. This is derived from either systolic or diastolic point locations as specified in the Setup screen.

BP Power Spectrum: The values plotted in this window are the spectral output of the BP Time Series.

Resp Time Series: The values plotted in this window are the signal mapped to Respiration sampled in milliseconds.

Resp Power Spectrum: The values plotted in this window are the spectral output of the Resp Time Series.

There are three colored bands shown on the HR Power Spectrum, BP Power Spectrum, and Resp Power Spectrum plots. Each represents a specific frequency range in the power spectrum. (VLF Band = Blue, LF Band = White, HF/RSA Band = Yellow).

In the upper right hand corner of the screen, the video selected during setup is displayed. Below it are the various video playback controls:

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 of the video and returns to the start of the segment.

Fast Forward: This control speeds playback of the video up to 2x normal speed.

Rewind: This control rewinds the video at 2x normal speed.

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

Position Slider: This control reflects the current position in both the physiological data and the video playback. It can be dragged to a certain location, at which point the video and the position cursor in the Scaled BP plot will be updated to reflect the new position.

By right-clicking the video and selecting Undock from the run-time menu, the video will be removed from the analysis window and re-opened in its own resizable, floating window.

To return the video to the analysis window, right-click the floating video window and select Dock from the run-time menu.

In the event that either the video is undocked or there was no video selected to be shown during setup, the video display is replaced by the BP Ensemble Elements plot.
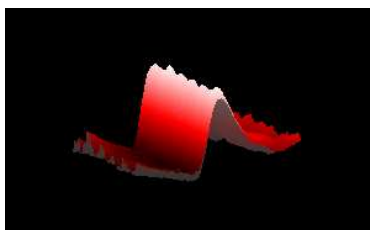
BP Ensemble Elements: The 3D plot displays the ensemble average of all of the BP waveforms found in this data segment. The plot can be rotated to show different views by selecting or holding the plot with the left mouse button and moving to a different viewpoint.

Below the video/ensemble plot and the video controls, in the lower right hand corner of the BPV Analysis screen are the calculated stats about the current data segment:

BP Stats: This table will contain one row when the calculation method is set to Entire. When it is set to Interval, there will be one row for each interval shown in the Scaled BP display. This table contains the following stats:

> **Mean Systolic:** This value represents the mean systolic amplitude.

> **Mean Diastolic:** This value represents the mean diastolic amplitude.

> **Mean MAP:** This value represents the average Mean Arterial Pressure amplitude.

Mean IBI: This value represents the mean Inter-Beat Interval.

Resp Rate: This value represents the respiration rate measured in breaths per minute.

Resp Pk Freq: This value represents the peak frequency in the Resp power spectrum.

Resp Amplitude: This value represents the mean respiration amplitude for this segment.

Resp Power: This value represents the spectral power in the respiration power spectrum.

HR: This value represents the mean heart rate for this segment of data.

RSA: This value represents the RSA value for the HR power spectrum.

 # BRS Series: Indicates the number of BRS series found during the current segment.

Avg BRS: This value represents the average ratio between the change in BP and the change in HR for all baroreflex events in this data segment.

Below these stats are the Power Stats for the HR and BP power spectrums, with the HR Power Stats shown on the first tab and the BP Power Stats shown on the second tab. The following statistics are available for both power spectrums:

VLF Power: This value represents the amplitude in the power spectrum at the frequency identified as VLF Peak Frequency.

LF Power: This value represents the amplitude in the power spectrum at the frequency identified as LF Peak Frequency.

HF/RSA Power: This value represents the amplitude in the power spectrum at the frequency identified as HF/RSA Peak Frequency.

VLF Peak Frequency: This value represents the peak frequency in the power spectrum as measured in the VLF Frequency Band.

LF Peak Frequency: This value represents the peak frequency in the power spectrum as measured in the LF Frequency Band.

HF/RSA Peak Frequency: This value represents the peak frequency in the power spectrum as measured in the HF/RSA Frequency Band.

LF/HF Ratio: This value represents the ratio of Low Frequency Power divided by the High Frequency Power.

1020-F Taylor Station Rd. Gahanna, OH 43230

Section 4: Output File

	A	B	C	D	E
1	Version	BPV v3.0A			
2	Date	3/19/2009			
3	Time	12:22 PM			
4	File Name	C:\Data\MW_Task_BPV.mw			
5	Analysis Mode	Event			
6	Event Filter	All Events			
7	Start Time	N/A			
8	Segment Time	N/A			
9	Event Mode	Pre and Post			
10	Pre-Event Time	0			
11	Post-Event Time	60			
12	Event to Use:	Any			
13	1st Event	N/A			
14	2nd Event	N/A			
15	# of Events	26			
16	Event/Time Event to Use	N/A			
17	1st Event	N/A			
18	Segment Time	N/A			
19					
20	Sampling Frequency	1000			
21	Volts Full Scale	10			
22	A/D Resolution	16 Bit			
23	mm Hg/volt	100			
24	Offset (mm Hg/volt)	0			
25	Calculation Method	Entire			
26	Interval Period	N/A			
27	Auto Cal Remove	No			
28					
29	Segment Number	1	2		
30	Event	F1	sync summary event # 1		
31	Event Time	20.125	40.188		
32	MAP	37.985865	38.411331		
33	Mean Systolic Amp	54.603671	55.04222		
34	Mean Diastolic Amp	29.676628	30.089569		
35	Mean IBI	0.743787	0.738475		
36	# Peaks Found	81	81		
37	Heart Rate	80.668202	81.248519		
38	HR Power	25723.04167	55831.60655		
39	HR Peak Freq	0.102041	0.08547		
40	HR RSA	6.878685	6.713326		
41	BP Power	15.114709	27.020011		
42	BP Peak Freq	0.212235	0.074906		
43	BP RSA	-0.775392	-0.836088		
44	BP/HR RSA Ratio	-0.112724	-0.124542		
45	Resp Rate	16.714893	17.379351		
46	Resp Power	0.01086	0.014161		
47	Resp Peak Freq	0.278582	0.289656		
48	Resp RSA	7.995363	7.845149		
49	Avg. BRS	NaN	0.434875		

There are three different output modes:

Text (.txt): Eight .txt files will be created:

*Filename*_**BPV_stats_*time*.txt:** This text file contains the calculated statistics from the specified segment of data.

*Filename*_**BPV_IBI_*time*.txt:** This text file contains the IBI series derived from the specified segment of data.

*Filename*_**BPV_systolic amp_*time*.txt:** This text file contains the systolic amplitudes derived from the specified segment of data.

*Filename*_**BPV_diastolic amp_*time*.txt:** This text file contains the diastolic amplitudes derived from the specified segment of data.

*Filename*_**BPV_MAP_*time*.txt:** This text file contains the MAP derived from the specified segment of data.

*Filename*_**BPV_HR Power Band_*time*.txt:** This text file contains the stats about each power band for the HR Power Spectrum in the specified segment of data.

*Filename*_**BPV_BP Power Band_*time*.txt:** This text file contains the stats about each power band for the BP Power Spectrum in the specified segment of data.

*Filename*_**BPV_BRS_*time*.txt:** This text file contains the stats about each baroreflex event in the specified segment of data.

Excel (.xls): An Excel spreadsheet file will be created containing eight worksheets:

BPV Stats: This worksheet (shown above) contains all setup information as well as the calculated statistics from the specified segment of data.

IBI Series: This worksheet contains the IBI series derived from the specified segment of data.

Systolic Amplitudes: This worksheet contains the systolic amplitudes derived from the specified segment of data.

Diastolic Amplitudes: This worksheet contains the diastolic amplitudes derived from the specified segment of data.

MAP: This worksheet contains the MAP derived from the specified data segment.

HR Power Band Stats: This worksheet contains stats about each power band for the HR Power Spectrum in the specified segment of data.

BP Power Band Stats: This worksheet contains stats about each power band for the BP Power Spectrum in the specified segment of data.

BRS Stats: This worksheet contains the stats about each baroreflex event in the specified segment of data.

Text and Excel: Outputs both .text files and an Excel spreadsheet file as specified above.

When in interval mode an additional worksheet and text file will be created titled **Interval Stats**, which contains the mean Systolic, Diastolic, MAP, and IBI from each of the intervals in the current segment.

Section 5: Peak and Trough Editor

The Peak and Trough Editor is an easy to use, yet powerful tool allowing for the modification of the placement of systolic and diastolic points detected programmatically from the detection algorithm. It is a graphical based editor and will carry any modification that is made back to the analysis screen. The editor has built in artifact detection algorithms and will dynamically update the graph as points are edited. The artifact detection algorithms can also be turned on or off from within the editor.

There are two waveforms visible from within the editor. Displayed in red is the BP time series with the peaks marked in blue and troughs marked in green. Displayed in purple is the respiration signal time series.

There is also a set of green horizontal cursors and blue vertical cursors. By selecting the crosshair tool under the graph the user can move the position of these cursors and then click the Delete all Points between X Cursors or Delete all Points between Y Cursors, all peaks/troughs detected

between their respective cursors will be deleted. This is especially helpful for removing large sections of systolic and diastolic points. This will only remove the markers on the BP waveform.

BP waveform graph: The BP waveform is displayed in red. The blue markers denote the systolic points as detected from the peak detection algorithm. The green markers denote the diastolic points as detected from the trough detection algorithm. The yellow circular markers with cross hair markers denote potential artifact detected by the error detection algorithms. The Y values are scaled in volts and the X values are in time (seconds.) The graph tools window in the bottom left has three tools for aid in editing. The tool with the cross hairs should be used for inserting and/or deleting points. The second tool, the magnifying glass, can be used to zoom in on the graph. The third tool, the hand, is used to scroll through the entire data set. The control in the bottom left corner can be used to zoom out the graph after zooming in by clicking on the X or Y button to zoom the graph back to its original position. This graph also contains cursors used to delete multiple points simultaneously. These cursors can be dragged freely to a desired location.

Peak/Trough: This control specifies whether the action being taken affects the peaks or troughs of the BP waveform.

Auto-Track Cursors: When activated, the cursors will retain their position on the screen as the data is scrolled through. When off, the cursors keep their position in the data and can leave the screen if scrolled past.

Resp or dZ/dt Color: This color box shows the current color of the respiration or dZ/dt plot. Clicking this control allows the user to change the color of this plot.

X0 (seconds): The X0 control determines where to start the graph in time. The user can slide this control to move their way through the segment in the edit screen.

Size of Graph (seconds): The Size of Graph control determines how much of the waveform to display at once. This value can be changed to fit less data onto the screen at once much like a zoom window.

Snap to Peak Control and Sensitivity Control: The snap to peak switch when in the "On" position will enable the snap to peak algorithm for point insertion. When the snap to peak switch is in the "OFF" position, it disables the snap to peak algorithm and allows for manual insertion of a point at the point clicked upon within the graph indicator. The time window control sets the size of the time window centered about where the mouse is clicked (ie: If the user clicked on a point at 10 seconds, the snap to peak function will cut out 250ms to the left and 250ms to the right of this point and determine the peak value within this range.) To successfully insert a point using the snap to peak setting, the user must also click the mouse within a band defined by the sensitivity control. The lower the sensitivity control, the more precisely the user must click on the exact spot of desired insertion. The higher the sensitivity control, the less precise the user needs to be, but

this can cause point insertion at a place other than the desired point and removal of too many points when deleting.

Midbeat Auto Peak Control and Time Window from R Peak Control: When the Midbeat Auto Peak Control is in the "On" position the mid beat algorithm is enabled. When the switch is in the "Off" position the midbeat control will mark a position exactly half way between the two selected points. The time window control defines the amount of time from each selected R Peak to go before finding a peak value (ie: If point 1 is at 1 second and point 2 is at 2 seconds and the time window is on 100ms, then the midbeat algorithm will find the peak value in the window from 1.1 seconds to 1.9 seconds.)

Set X Cursor Position: The Set X Cursor Position brings up a window through which the user can set the high and low position of the X cursors by changing their numerical value. The Cursor Pos X Low and Cursor Pos X High show these settings.

Set Y Cursor Position: The Set Y Cursor Position brings up a window through which the user can set the high and low position of the Y cursors by changing their numerical value. The Cursor Pos Y Low and Cursor Pos Y High show these settings.

Delete (F1): This control latches when pressed until a valid mouse click within the graph area is received, if the points are within the range defined by the sensitivity control and the mouse click they will be deleted.

Note: Having the sensitivity to high or too low will result in too many points being deleted or not enough depending on the signal quality (noise, etc) and the rate of signal being edited.

Insert (F2): This control latches when pressed until a valid mouse click within the graph area is received, if the points are within the range defined by the sensitivity control and the mouse click they will be inserted at the point of the mouse click or at the peak/trough defined by the snap to peak window control above as long as snap to peak is on.

Delete All Points Between X Cursors: All points within the boundary defined by the vertical blue cursors will be removed.

Delete All Points Between Y Cursors: All points within the boundary defined by the horizontal green cursors will be removed.

Remove Data Portion: This control will remove all data within the boundary defined by the cursors.

Midbeat: This control will mark a Midbeat point between two points selected with the cursor window and described above in the Midbeat controls sections.

Reset: This control resets the peaks and troughs to the original state when the editor was first entered.

Artifact Detect Settings: Allows the user to turn on and off the artifact detection algorithms and settings.

OK and Cancel: When editing is complete and the user wants the changes to transfer back to the analysis screen, select OK. When the user selects Cancel, the data that has been edited will not be transferred and the editing will be lost.

Section 6: BPV Artifact Settings
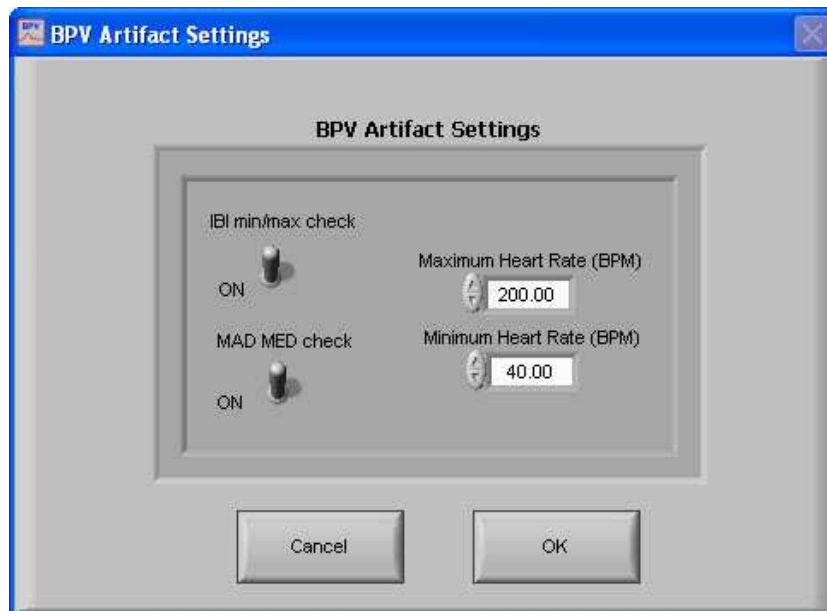
The BPV Artifact Settings window allows the user to change these settings without exiting the analysis session.

MAD/MED Check: This control enables or disables the application of MAD/MED criteria to the heart beat detection.

IBI Min/Max Check: This control enables or disables the application of IBI Min/Max criteria to the heart beat detection. The algorithm will test the IBI series to be in range of the settings selected in the Minimum Heart Rate and Maximum Heart Rate controls.

Minimum Heart Rate (BPM): This control allows for the selection of the minimum expected heart rate in the data series. This value will be the minimum IBI threshold.

Maximum Heart Rate (BPM): This control allows for the selection of the maximum expected heart rate in the data series. This value will be the maximum IBI threshold.

Section 7: Video Settings

The Video Settings Window allows the user to modify these settings without exiting the current analysis setting.

Show Video: Sets whether the video will be shown during analysis or not.

Auto-Play: When this is turned on, the specified video will automatically begin playback when a new segment is selected. Otherwise, the video will not begin playback until it is started by the user.

Appendix A: ASCII-MW Converter
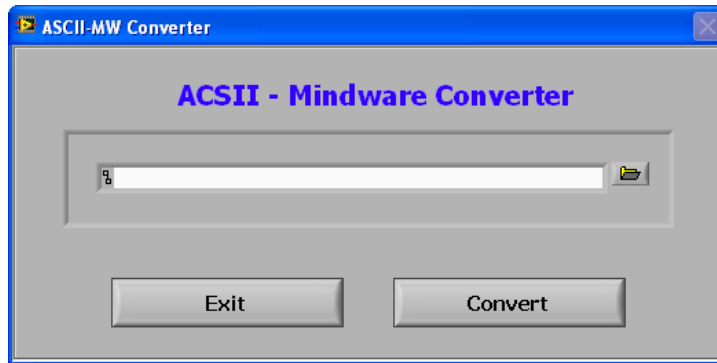
The ASCII-MW Converter allows the conversion of any text file containing data in tab-delimited columns to the .mw format so that it may be used in any analysis application. To begin conversion, select a text file containing data by using the browse button on the file path control and pressing Convert. To exit the converter and return to the setup screen, press Exit.
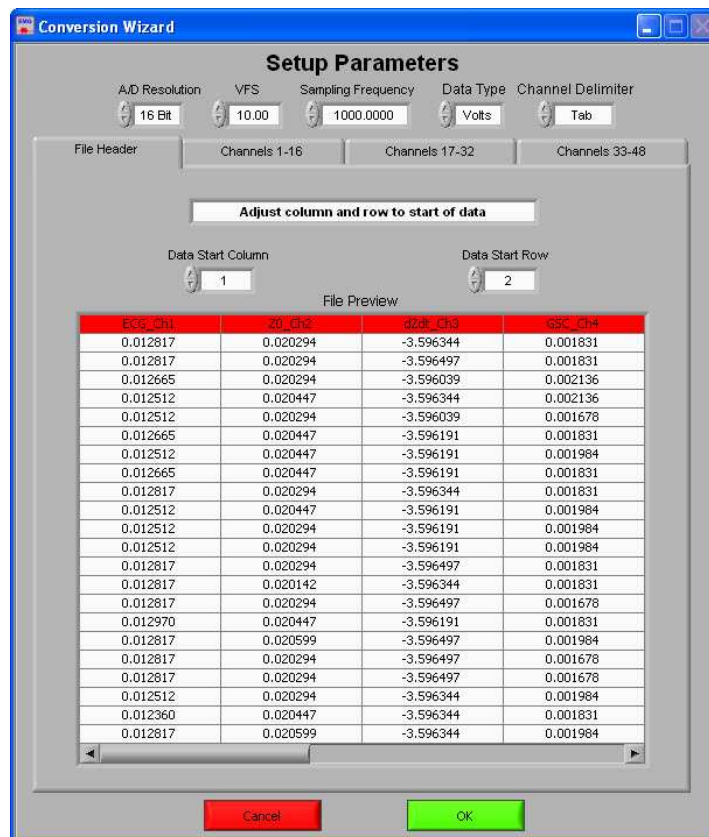
The next screen in the conversion process is the Text File Conversion Wizard. From this screen, details about the data in the text file must be entered in order to properly scale and display the data in the analysis applications. It is extremely important that these values are identical to the way the 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.

VFs: 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.

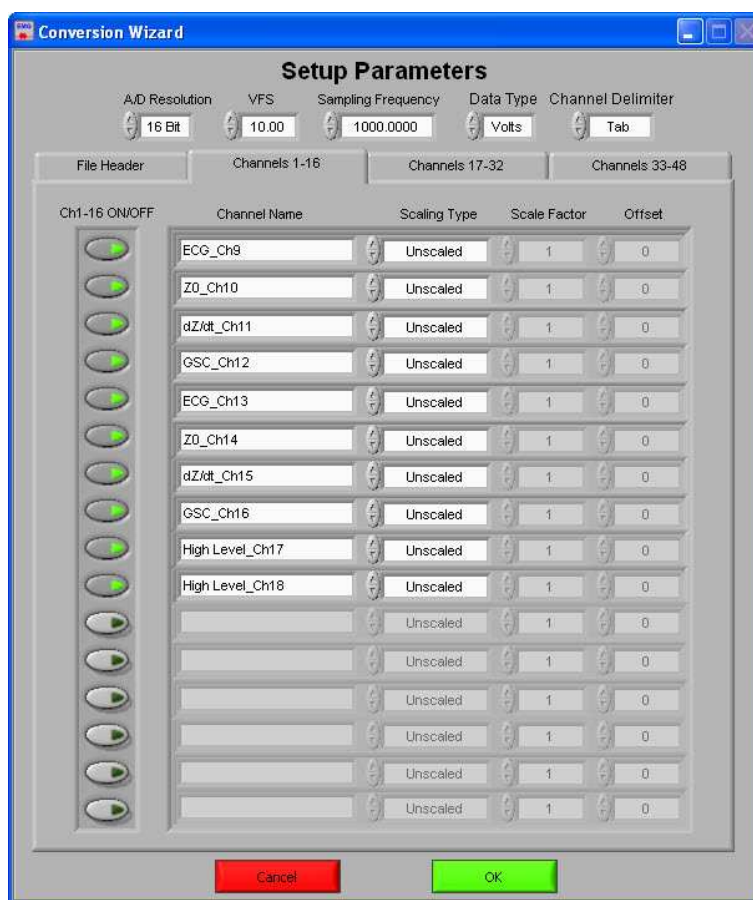**Data Type:** This control specifies whether the data in the file is in volts or A/d counts.

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.

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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.

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