

Data Review Option

Model: PNM-P3P-005, PNM-P3P-008, PNM-P3P-016, PNM-P3P-032, PNM-P3P-064, AND PNM-P3P-POST
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Overview

Introduction

The **Data Review** option permits the user to review any acquired or replayed file. When the user enters Review Mode, the corresponding graphical and derived information is displayed. The user can then modify the placement of validation marks on segments of waveform data while relying on P3 Plus to calculate derived parameters based on the newly placed validation marks. Visual indications of the changes are provided along with their effects on the calculated derived parameters. Multiple sets of validation marks information may be saved and compared. A .LOG file keeps track of any changes, along with the reasons for making the changes. The parameter searching capabilities included in Data Review ease the process of identifying and locating the desired data.

The Review file, (.RVW file) can be opened in the P3 Plus application by utilizing the menu selection **Open Review File** from the **File** menu (in Idle mode) or the **Functions** menu (in Review mode). This file is subject to all of the analysis and protocol settings available during a typical acquisition or replay session. Each .RVW file is linked to an associated .RAW file.

Analysis attribute settings can be modified and then applied to the entire .RVW file or to selected sections, allowing the analysis to be adjusted to accommodate changes in the signal data. It is also possible to relocate validation marks that have not been correctly placed by the automated analysis, flag sections of data as “bad,” isolating these sections from reported numeric summaries, and manually insert validation marks on sections that may have been ignored by the original analysis. All of these modifications will be tracked in the corresponding numeric data files.

Enhanced graphics capacities exist in Review that allows the data to be easily expanded or compressed to locate points of interest. Data is easily scrolled forward or backward in the graphic displays and numeric tables. Additionally, a synchronization capability exists between the graphics pages and the derived data numeric listing. This capability is bi-directional, allowing graphic data to be synced to the numeric table, or the numeric values to be synced to the graphic display. Numeric data can also be “sorted” by a simple mouse-click on the column header of interest. Graph setup and configuration is also available “on line” with no need to exit the Review session.

The changed review file can be saved with all modifications, including any .PRO changes, while in the Review mode.

Installation

The installation of the **Data Review** option is done when the main **P3 Plus** application is installed and the Data Review option is enabled in the license file.

Note:	Data Review capable analysis modules must be used. Only channels using these modules will be available in the Review file.
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Basic Features

Main Review Window

When opening a review file a dialog will appear asking the user to select which channels should be opened in review. This allows the user to disable any unwanted channels that do not need to be modified in review. See Section **Select Review Channels** for more details.

In Review Mode, the main P3 Plus window becomes the main Review window, and it contains derived output and event windows along with status items specific to Review. The title bar of the main window shows the name of the review file that was opened along with the name of the current user.

Menus

Function: Open Review File

Closes the current review selection and prompts the user to select a new .RVW file. See *Opening a Review File*.

Function: Open Marks Section

Brings up a dialog that lists the marks sections that are available in the current Review file. Selecting a marks section will load its marks information into the current and reference sections and update the graphics and derived data accordingly.

Function: Save Marks Section

Permits saving the current marks information using a user specified name. The user can also save derived data from this dialog.

Function: Save Derived Data

Permits saving the derived data using a user specified name.

Function: Delete Marks Section

Brings up a dialog that lists the marks sections that are available in the current Review file. Deleting a marks section will remove its marks information from the Review file.

Function: Open Reference Section

Brings up a dialog that lists the marks sections that are available in the current Review file. Selecting a reference section will not change current marks positions or the derived output but it may result in the display of change markers where differences exist between the current and reference sections.

Function: Save Review Protocol

Saves protocol information in the protocol section that exists within the Review file. See *Protocol Information and Marks Sections*.

Function: Save Review Protocol As

Creates a copy of the current Review file with the current protocol settings. Prompts the user for the name of the new Review file. See Protocol Information and Marks Sections.

Function: Export Protocol

The protocol information in a review file may be exported to create a new .PRO file by using the **Export Protocol** selection in the **Functions** menu (only the rules and advanced options for data parser are exported).

Function: BDM Percentage

This feature provides the ability to view the percentage and distribution of data removed by Bad Data Marks.

Function: Logging Rate (F8)

Permits changing the frequency with which derived data are displayed. See Derived Output.

Function: ASCII Output

Permits creating an ASCII Output from the P3 Plus window. See ASCII Output.

Function: Copy Selection

Provides a means to run Template Analysis across all channels with a valid library binding.

Function: Batch Template Analysis

View the Template Analysis Manual (MU00279) for details on how template analysis operates.

Function: Close Review Session

Ends a Review session and returns P3 Plus to Idle mode.

Function: Recent Review Files

Lists the last four review files that were opened.

Setup: P3 Setup...

Brings up the P3 Setup dialog. See Protocol Information and Marks Sections. The **PPP3 Setup** dialog has a limited list of options that can be changed in Review. All other options will be disabled.

Setup: Review Print Setup

Displays a dialog to set up print options. See Printing.

Data Parser: Save Parsed Review File

This selection allows the user to save a RVW/RAW file pair that consists of only the data parser segments set up in the Data Parser Dialog.

Data Parser: Save Parsed Derived Data

This selection allows the user to save the derived data based off of the existing data parser segments.

Data Parser: Parser View Mode

This selection toggles between Parser View Mode and Review Mode.

Data Parser: Open Data Parser Dialog

This selection allows the user to view the Data Parser segments based on time, the rules that are configured, and which channels to parse.

Data Parser: Show Parser Bar in Graphs

This selection toggles the Parser Bar in the graphs.

Options: Audit Reason Codes

Permits modification to preset Audit Reason Codes. See P3 Plus Reference Manual.

Options: Application Configuration

Permits the user to view and make changes to the **Application Configuration** dialog.

Windows

The default selections of **Tile Horizontally**, **Tile Vertically**, **Cascade**, and **Arrange** are listed along with Review specific child windows.

The child windows that may be created during a review session are:

DRx - contains derived parameters reported at the current logging rate. See DRx.

Data Reduction - contains data reduction output. See Data Reduction.

Events - Lists active events. See Events.

Current Marks Section

This is a field in the status bar along the lower edge of the main window. The text area to the right of the *Current* label lists the current marks section. See Protocol Information and Marks Sections.

Reference Marks Section

This is a field in the status bar along the lower edge of the main window. The text area to the right of the *Reference* label lists the reference marks section. See Protocol Information and Marks Sections.

Marks Changed Indicator

This is a field in the status bar along the lower edge of the main window. The field to the right of the *Current* label contains an asterisk * if the current marks section contains changes from the reference marks section. See Protocol Information and Marks Sections.

Raw File

This is a field in the status bar along the lower edge of the main window. The text area to the right of the *Raw File* label lists the path and file name of the Raw file associated with the Review file.

Review Graph Pages

Review supports Primary, Trend, XY-Loop, Scatter, PV Loop, Page View, and Template (ECG PRO) graph pages.

NOTE: Refer to Template Analysis Manual MU00279 for information regarding Template graph pages.

The number of graph pages supported is the same as in acquisition and replay. A description of the graph pages follows. A selected channel is the current channel or trace that is selected in the graph page. This is shown by the outlined trace label and high/low axis values.

NOTE: Derived parameter based presentations will not work on the primary graphs, they are not supported. It is recommended to configure a trend graph if derived parameters need to be graphed.

Menus and Toolbar

File: Print



Prints the current graph page based on the current Review Print Setup. See Printing.

File: ASCII Output



This option brings up a dialog for the user to create ASCII Output based on the options selected.

Edit: Expand



Expands the time span (X axis).

Edit: Compress



Compresses the time span (X axis).

Edit: View Entire Data Set



Scales the X axis to display all available data.

Edit: Snap Zoom In



Use to expand the X axis to display the selected region. (Select icon and drag mouse to zoom in selection). When this is used on an XY-Loop or Scatter graph, it changes both the X and Y scaling.

Edit: Snap Zoom Out



Use to compress the X axis to display the current X axis range in the area selected. (Select icon and drag mouse to zoom out selection). When this is used on an XY-Loop or Scatter graph, it changes both the X and Y scaling.

Edit: Undo Graph Time Change



Removes the last graph time change, reverting back to the previous state. This feature will not be available if **Enable Difference Calculations** is disabled in the Review dialog. This is accessed through the Application Configuration dialog from the Tools pull down menu.

Edit: Sync with Derived Data



Syncs derived and data reduction list views with the current cursor position.

Edit: Change - Search Right



Searches for the next change marker in the selected channel. This feature will not be available if **Enable Difference Calculations** is disabled in the Review dialog. This is accessed through the Application Configuration dialog from the Tools pull down menu.

Edit: Change - Search Left



Searches for the previous change marker in the selected channel. This feature will not be available if **Enable Difference Calculations** is disabled in the Review dialog. This is accessed through the Application Configuration dialog from the Tools pull down menu.

Edit: Note - Search Right



Searches for next Note in the selected channel.

Edit: Note - Search Left



Searches for previous Note in the selected channel.

Edit: Event - Search Right



Searches for next Event in the selected channel.

Edit: Event - Search Left



Searches for previous Event in the selected channel.

Edit: Parser Segment - Search Right



Searches for the next Parser Segment.

Edit: Parser Segment - Search Left



Searches for the previous Parser Segment.

Edit: Time - Search



Searches for a specific time in the selected channel.

Edit: Unmatched - Search Right



Searches for the next unmatched cycle (Template Analysis feature).

Edit: Unmatched - Search Left



Searches for the previous unmatched cycle (Template Analysis feature).

Edit: Bad Data Mark - Search Right



Searches for the next bad data mark.

Edit: Bad Data Mark - Search Left



Searches for the previous bad data mark.

Options: Draw Validation Marks



Toggles the Validation Marks for all channels in the graph page.

Options: Draw Mark Differences



Toggles the Mark Differences on the graph page. This feature will not be available if **Enable Difference Calculations** is disabled in the Review dialog. This is accessed through the Application Configuration dialog from the Tools pull down menu.

Options: Draw Parser Segment Watermarks



Toggles the Parser Segment Watermarks on the graph page.

Edit: Free Form Select (Scatter Graph only)



Allows the user to select only specific marks.

Options: Non-Continuous Mode (Scatter and XY-Loop Graph only)



Toggles between continuous and non-continuous modes.

Options: Clear Graph (Scatter and XY-Loop Graph only)



Clears the graph of the current information.

ET (Elapsed Time)

This field is located in the lower left corner of the Graph Page and displays the elapsed time at the cursor's position.

Delta Time

This field is located in the lower left corner of the Graph Page and displays the time interval between the current position of the cursor and point at which the Delta Time was reset. To reset Delta Time, first position the cursor by performing a left mouse click at the desired reference point. Next, perform a right mouse click to bring up the right mouse menu and select **Reset Delta Time**.

Display Pane

Each channel that is displayed in a graph page has an associated display pane that contains a graphical representation of the selected presentation.

Label Area

Each channel that is displayed in a graph page has an associated label area to the left of its display pane that contains the channels label and scaling information.

ID Text

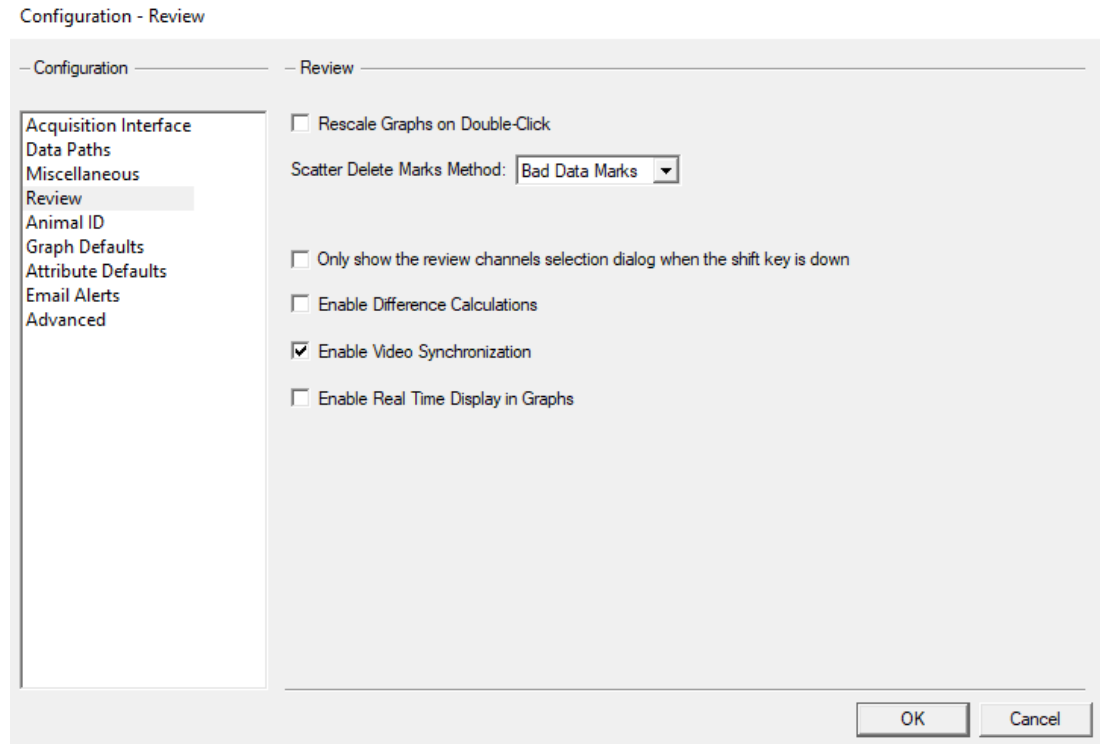
This field lies to the right of the Delta Time field and is used to provide additional information about marks, events, and bad data marks. Placing the mouse cursor over one of these objects will display a descriptive text string in this field.

Dragging and Dropping Data

The user has the capability of dragging and dropping selected data from the DRx and Data Reduction list views of the main review window to the graph pages. This allows the user to select specific data in the list view and view that data in the graph pages easily.

Application Configuration

The **Application Configuration** dialog is accessed by selecting **Application Configuration** under the **Options** drop-down menu. Selecting the **Review** tab allows the setup of various review based options. Below is a basic description of the options.



Review tab in Application Configuration dialog

The **Rescale Graphs on Double-Click** check box allows the user to enable or disable rescaling of the graphical data when double-clicking on the Derived list views or the Data Reduction list views in Review mode.

The **Scatter Delete Marks Method** drop down list box has the options **Bad Data Marks** and **Delete Cycles**. The **Bad Data Marks** option inserts bad data marks in the locations lassoed, while the **Delete Cycles** option removes the marks associated with the cycles that were lassoed. The use of this feature in a scatter graph is outlined in greater detail below in the Scatter Graph Page section.

The **Only show the review channels selection dialog when the shift key is down** check box allows the user to set how review files are opened. When this check box is checked, the dialog that asks which channels to open in review will not appear. By default, all channels in the review file will be opened. When this check box is not checked, the dialog that asks which channels to open in review will appear. This will allow the user to select channels to be opened for that review file.

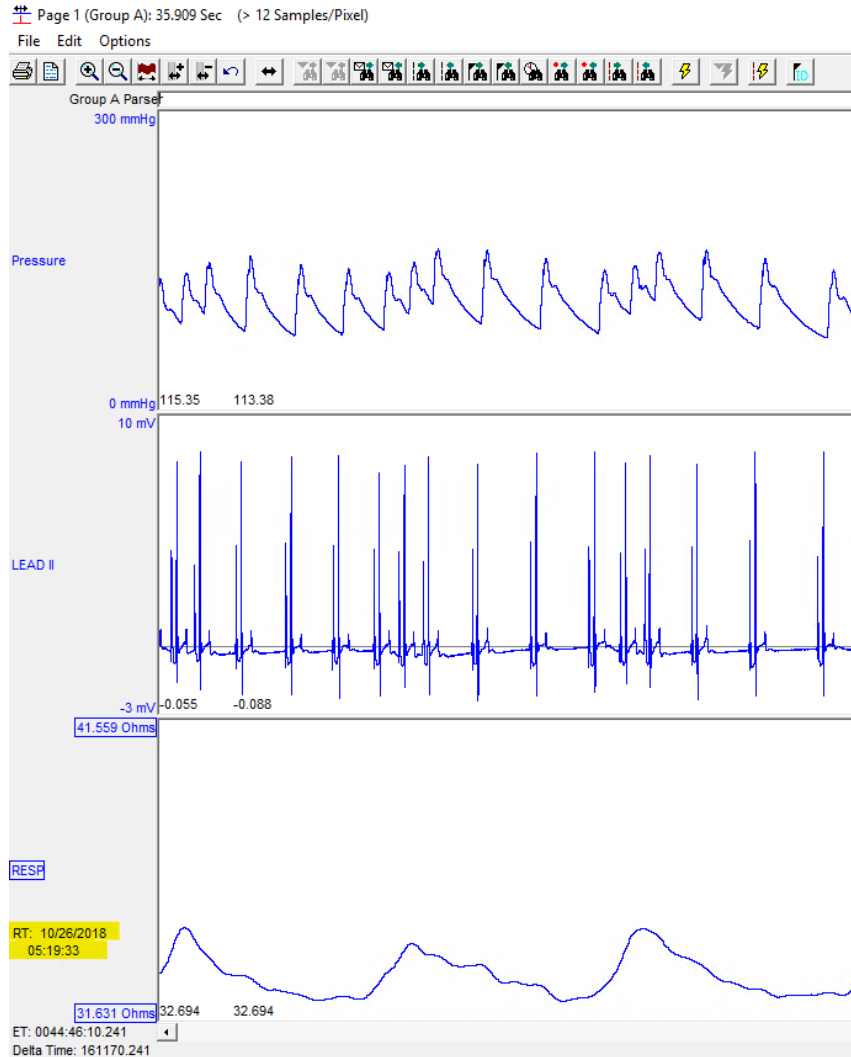
Enable Difference Calculations provides performance improvements when reviewing large datasets by not committing memory allocations for cycle and mark information for the Reference section. With this feature disabled, mark differences will not be calculated or viewable on the graph page which improves system performance. Although differences will not be displayed, individual mark movement is still logged in the experimental log file.

This feature may be changed during review. Any difference marks that exist will be removed when this option is disabled. Open reference section will be disabled along with the Toggle Mark Differences, Search Previous/Next Change and Undo Move features. Additionally, any changes to the derived data will not be displayed (cells grayed) when this feature is disabled, and N/A will be displayed for the reference name on the main Ponemah window.

If this feature is enabled after being disabled, previous mark changes will be displayed and features that were disabled as a result of the setting will again be enabled.

Enable Video Synchronization provides synchronization between video files, graphical data and data files when in Review. If video synchronization is disabled, no video cursor shall be shown on graph pages and there is no sync between video and graph pages/derived data.

Enable Real Time Display in Graphs provides an option to display the date and time of the data displayed in the graph. The Real Time data is displayed in the bottom left of the graph page as highlighted in the screenshot below.

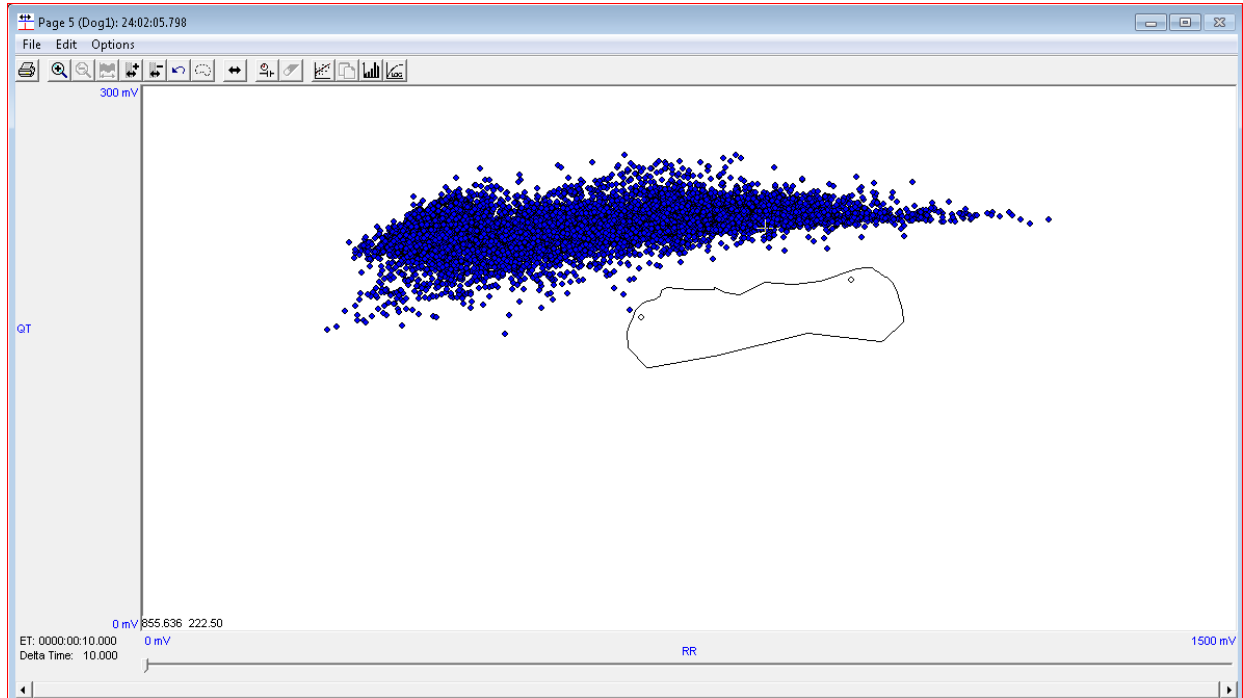


Scatter Graph Page

Free Form Select

The Scatter graph has a free form select feature that the other types of graph pages do not have. This feature allows the user to draw a free form drawing around

specific points of interest. Below is an example of a scatter graph with a free form drawing.



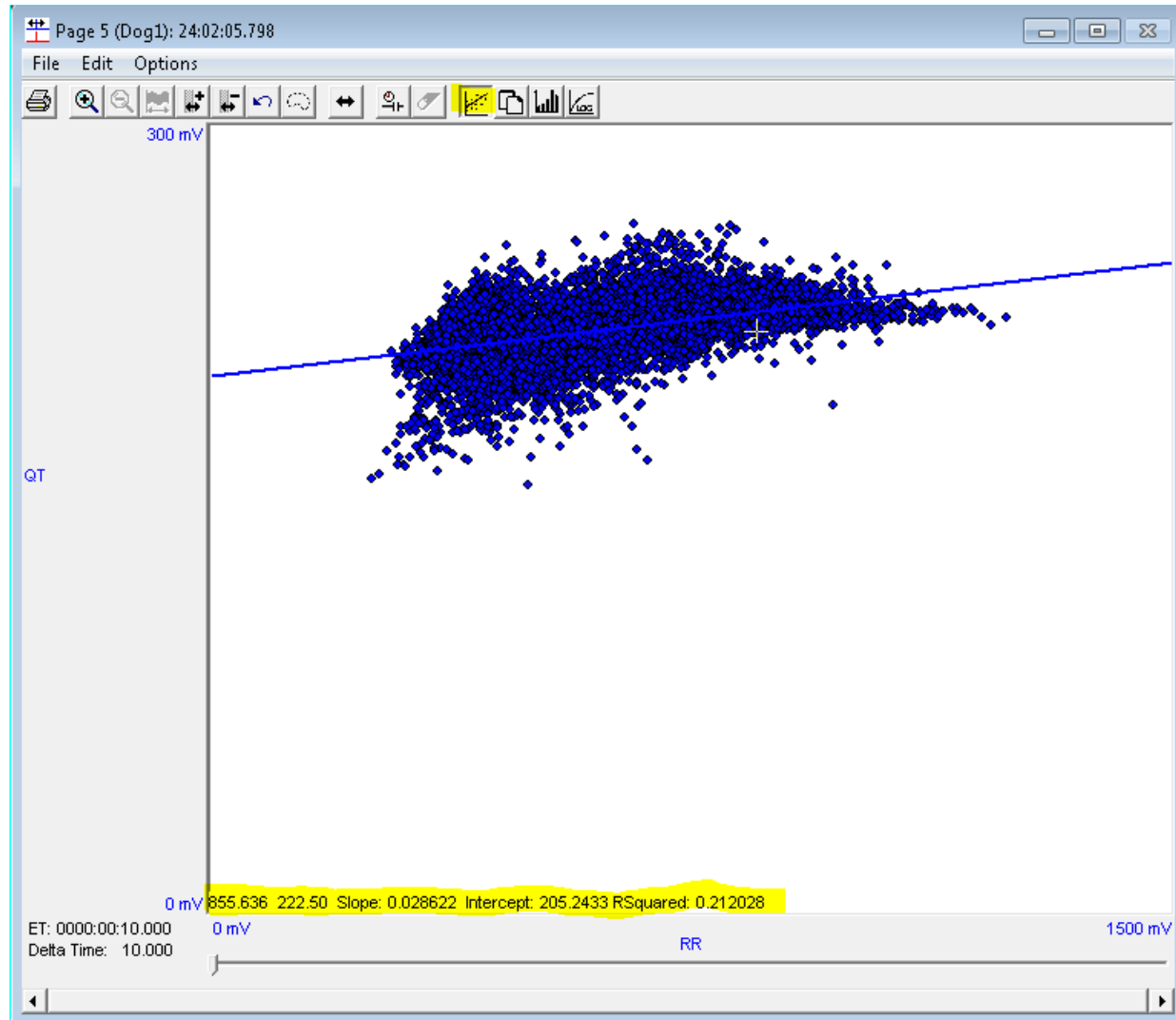
In the above case the two outliers were drawn around and selected. From here the user can right click on the graph and they are presented with two options dependent on the scatter delete method selected. This will be discussed later.

When the **Bad Data Marks** option is the method selected in the **Scatter Delete Marks Method**, the options available are **Add Bad Data Marks to Selected Points** and **Add Bad Data Marks to Unselected Points**. When different channels are configured to the X and Y axes, a sub menu will appear when one of the above options is selected to ask which channel the bad data marks should be added.

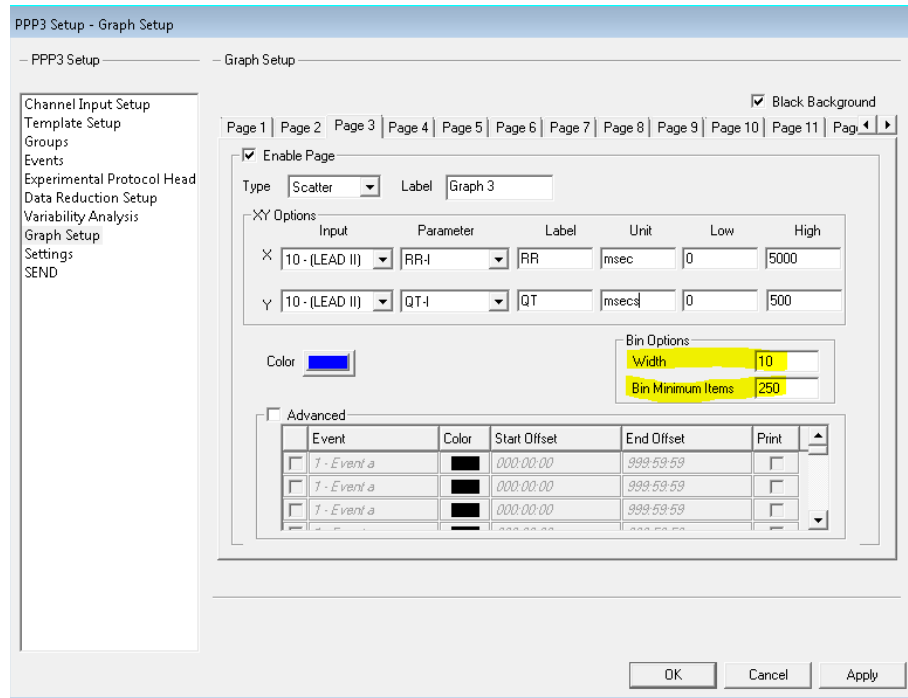
When the **Delete Cycles** option is the method selected in the **Scatter Delete Marks Method**, the options available are **Remove Cycles from Selected Points** and **Remove Cycles from Unselected Points**. When different channels are configured to the X and Y axes, a sub menu will appear when one of the above options is selected to ask which channel the cycles will be removed.

Linear Regression

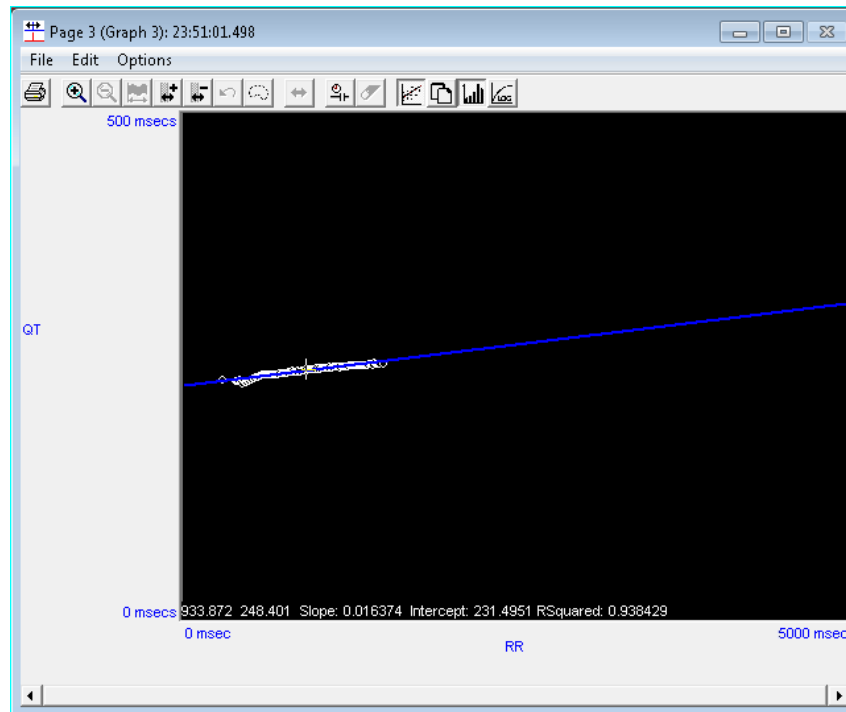
A Linear Regression line may be calculated and plotted in the scatter graph window. This is feature will calculate and report in the bottom window of the graph page the slope, intercept, and R-squared value (see screenshot below). The calculated values for slope and intercept can be copied to a variable created within the Custom Derived Parameters dialog by selecting the **Copy Linear Regression Results** icon. The Custom Derived Parameters section explains how to create variables to store slope and intercept values.



Toggle Binned Average Mode is a function to bin the data using user specified bin width and reporting a single point average for the defined bin widths. Bin width and minimum items required to represent the bin width average is specified in the Graph Setup (in P3 setup) on the Scatter graph page (see figure below). This step would be required when calculating the heart rate correct QT correction using the Hank Holzgrefe method within Ponemah.



The linear regression line can be enabled to calculate the linear regression line for the binned data.

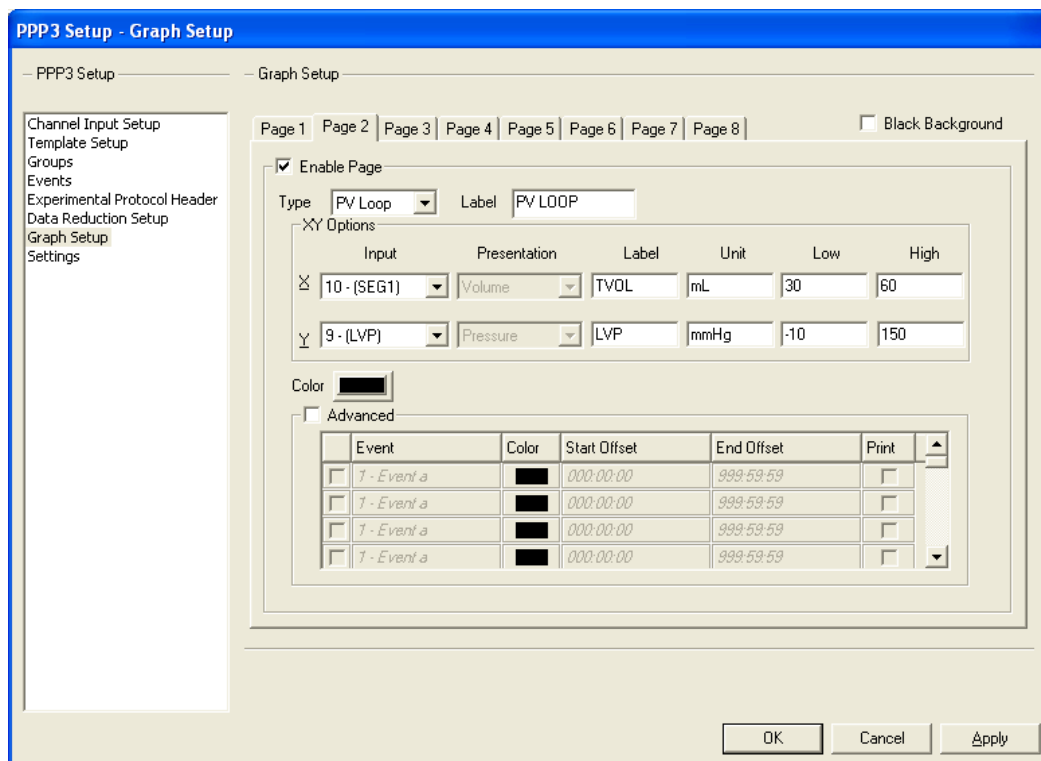


Toggle Log Mode is a function to plot the data using a logarithm scale for either the x or y axis or to use a logarithmic scale for both the x and y axis.

PV Loop Graph Page

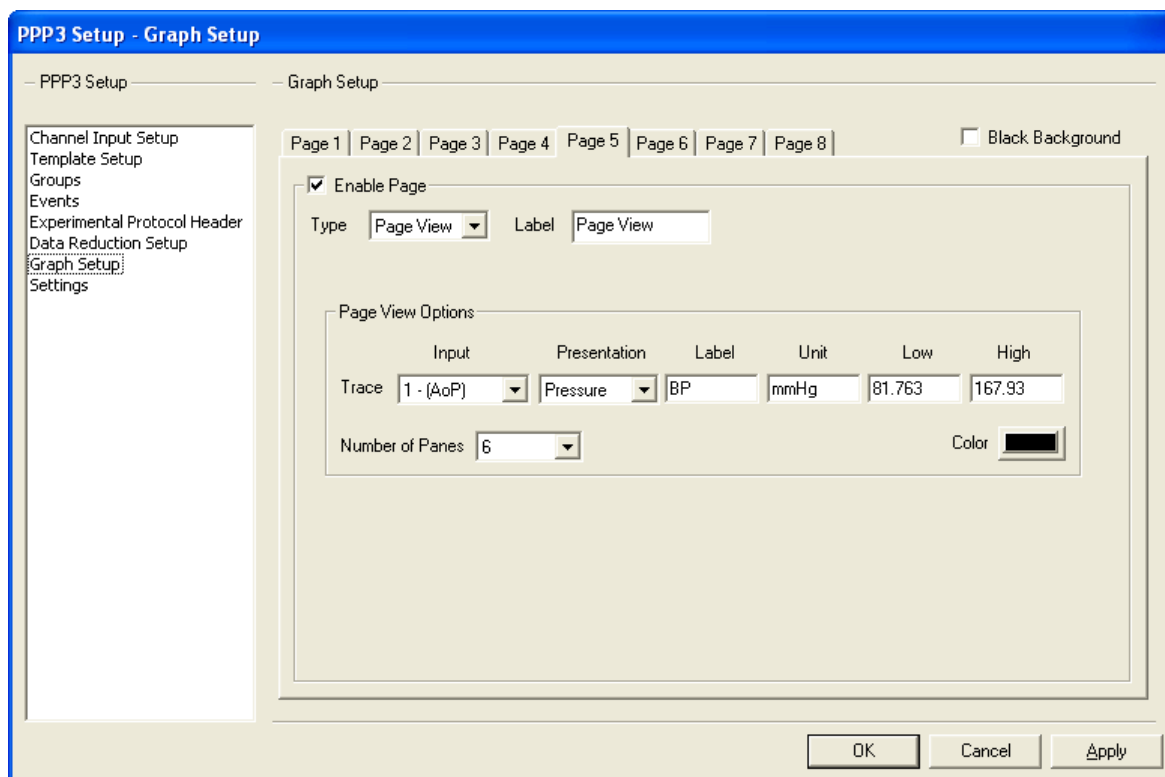
Review also has the option of configuring a PV Loop graph. This allows the user to view LVP and CVOL signals as an XY graph and is also used to display the results of the analysis.

Below is a screen capture of a PV Loop graph page setup.



Page View Graph Page

Review also has the option of configuring a Page View graph. This allows the user to view the same channel of continuous data on multiple panes. The operation of the graph page is the same as a primary graph page. The amount of panes configured is set up when selecting the page view graph page in the Graph Setup. Below is a screen capture of a page view graph page.



The number of panes that can be configured are from 1 to 16.

Example: If 6 panes are configured and the time set for the graph is 1 minute (60 seconds), there will be 10 seconds worth of data in each pane. When viewing the panes, the data wraps from one pane to the following pane.

Operation

Creating a Review File

A Review file is created each time an acquisition is made or a replay is performed. The Review file will have the same name as the acquisition or replay data set name.

The P3 Plus installation includes a FULLDEMO.PRO and an associated .RAW file which can be used to create review files.

- Start the P3 application. Then select **Open Protocol** from the **File** menu.
- Select FULLDEMO.PRO then click on the **Open** button.
- From the **Replay** menu, select **Data Set Name**.
- Type in a name for the Review file that will be generated.
- Click on the **Save** button. Now when the file is replayed, a review file with the selected name will be created.
- A .RAW file name that contains the data now needs to be selected. Select **Replay Filename** from the **Replay** menu.
- Select the .RAW file that is to be replayed. In this case, select FULLDEMO, and then click on the **Open** button.
- Select **Start Replay** from the **Replay** menu.

Allow the replay to completely finish only if you wish all analysis marks to be applied to the entire dataset. If you stop replay early, all RAW data will be visible, however, only marks that were replayed will appear in Review. All events generated in acquisition will appear in review. However, a more efficient method would be to start Replay and immediately stop the Replay which will then generate the Review file. You can then analyze each channel instead of waiting for the entire file to replay.

After exiting replay, a Review file with the selected name will be created.

An alternative method of creating a Review file is to create a copy of an existing review file in Review Mode by selecting **Save Review Protocol As** from the **Functions** menu which will prompt the user for a new Review file name and save the current review file with all its marks sections and the current protocol settings.

Opening a Review File

Review files can be opened while in Idle mode (the **Open Review File** menu selection from the **File** menu) or while in Review Mode (the **Open Review File** menu selection from the **Functions** menu). Each Review file has an associated RAW file. On opening a review file, the software also opens its associated .RAW file. If this .RAW file is not found, the user is prompted to locate the .RAW file. Once the .RAW file is located, protocol information is loaded from the Review file along with the most recently saved marks information and signals and derived parameters are displayed.

Note: When opening large data files, Review may take some time to complete its calculations. The progress is noted on each windows title bar. The user can proceed with reviewing data and moving marks prior to the completion of calculations. The saving of derived data cannot be done until the calculations have completed.

Note: Opening earlier versions of Review files is not supported.

Select Review Channels

Once a review file has been selected the **Select Review Channels** dialog will appear. This dialog allows the user to deselect any unwanted channels for review.

	Channel	Analysis	User Label	User Unit	Group
<input checked="" type="checkbox"/>	1 - (1035256 - Pressure	BP	Pressure	mmHg	A
<input checked="" type="checkbox"/>	2 - (1035256 - ECG)	ECG	LEAD II	mV	A
<input checked="" type="checkbox"/>	3 - (1035256 - Respirati	PVO	RESP	Ohms	A
<input checked="" type="checkbox"/>	4 - (1035256 - Tempera	TEMP	Temp	Celsius	A
<input checked="" type="checkbox"/>	5 - (1035256 - Accelero	ACT	ActX	Counts	A
<input checked="" type="checkbox"/>	6 - (1035256 - Accelero	ACT	ActY	Counts	A
<input checked="" type="checkbox"/>	7 - (1035256 - Accelero	ACT	ActZ	Counts	A
<input checked="" type="checkbox"/>	8 - (1035256 - Activity)	ACT	Activity	Counts	A
<input checked="" type="checkbox"/>	9 - (1035257 - Pressure	BP	Pressure	mmHg	B
<input checked="" type="checkbox"/>	10 - (1035257 - ECG)	ECG	LEAD II	mV	B
<input checked="" type="checkbox"/>	11 - (1035257 - Respira	PVO	RESP	Ohms	B
<input checked="" type="checkbox"/>	12 - (1035257 - Temper	TEMP	Temp	Celsius	B

Only show this dialog when the shift key is down

When the dialog appears it will list every channel that was acquired/replayed along with the analysis module, label, unit, and group information.

Clicking on the check box on the left will select/deselect each of the channels. This way, when review is opened, any unwanted channels that were acquired/replayed will not appear in review. Alternatively by clicking **Toggle All**, all channels that are selected will be un-selected and all channels that are not selected will be selected.

The check box **Only show this dialog when the shift key is down** allows the user to set up if the **Shift** key needs to be pressed for this dialog to appear. If the check box is disabled, the dialog will always appear. If the check box is enabled, the dialog will only appear if the **Shift** key is pressed when a review file is opened. Once the user selects the .RVW file from the browse dialog the shift key will need to be pressed prior to the **Open** button being selected. Also, if the user is selecting the .RVW file from the recently used list, the shift key will need to be pressed prior to clicking on the specific .RVW file.

The check box **Only show this dialog when the shift key is down** can be reset back to being unchecked two different ways:

1. When opening a review file, hold down the shift key. When the **Select Review Channels** dialog opens, uncheck the check box and click on the **Apply** button.
2. Select **Application Configuration** from the **Options** menu, select the **Review** tab, and disable the **Only show the review channels selection dialog when the shift key is down** check box.

The **Select Review Channels** dialog has two available buttons, the **Apply** and **Skip** buttons. The **Apply** button will include and exclude the channels selected on the **Select Review Channels** dialog. The **Skip** button will open the review file and include all channels available even if channels were deselected on the dialog.

If all channels are deselected and the user clicks on the **Apply** button, a message box will appear stating "No review channels available. Please correct selections." This will allow the user to select at least one channel prior to opening review.

When a review file is opened and channels are excluded from the list, P3 Plus will take the following actions:

- Excluded channels will be listed as DIS in the Channel Input Setup configuration.
- Excluded channels will be disabled in all graphs. If a graph includes only excluded channels, that graph will be disabled.
- Marks information and attributes for excluded channels will still exist if the review file is reopened with the excluded channel included.
- Graph settings will still apply if review file is reopened with the excluded channel included. However, if modifications are made to the traces or graphs of excluded channels, those settings will be completely overwritten.
- If an excluded channel is the trigger channel for a group, the first available channel for that group will be set as the trigger channel. If the trigger channel is not changed, and the review file is reopened with the excluded channels included, the trigger channel will be correctly reset to the original channel.
- List views for groups that are completely excluded will not appear. This includes DRx and Data Reduction list views.
- Events for groups that are completely excluded will not be listed in the Events list view.

Derived Output

This section describes the numeric output provided by P3 Plus while in Review Mode. Derived output is made available in the main Review window while in Review Mode. When derived data is saved, the derived output is also sent to text files and/or ODBC depending on the settings in the **ODBC Interface** configuration in the **Application Configuration** dialog. Derived data can be saved when saving a marks section by selecting the **Save Derived Data** check box on the **Save Marks Section** dialog. Invalid or unknown data are represented as an 'x' in review and in the text files. In ODBC unknown or invalid data are represented as 9.999e+15.

DRx

Derived parameters are reported at the current logging rate. The logging rate may be changed through the **Logging Rate** menu selection of the **Functions** menu, or by hitting the F8 key. If Epoch mode is chosen, the trigger channel may be changed through the **PPP3 Setup** dialog by selecting the **Groups and Events** selection. If a logging interval spans multiple cycles, data will be averaged, please refer to the analysis manual for information on how each derived parameter is averaged.

If the logging rate is set higher than the available data, no information will be listed in the DRx list view.

Percent Complete

If a large Review file is opened, Review calculates the derived output in the background while permitting the user to interact with the data. The title bar of the DRx window(s) indicates the percentage complete. Saving of derived data and sorting of data are not permitted until all derived parameters have been calculated.

Sorting

Once all the derived parameters have been calculated, they may be sorted by clicking on the derived parameter header. A second click will invert the sorting order. To return the values to their original order, click on the Time column. This feature coupled with the ability to sync a derived line with the graphical data is a convenient method for examining outliers.

Logging Intervals

When in Time mode, if a cycles logging mark falls within a logging interval, the derived output for the cycle will be included in that logging interval. When in Epoch mode the logging interval is represented by the specified number of cycles of the epoch channel. Each logging interval starts at the beginning of the first cycle in the interval and ends at the end of the last cycle in the interval. Please refer to the Analysis module manual for details on where cycles start and end.

Comparison to the Reference Marks Section

If any of the beat data that comprise the information in a derived data value differs from the corresponding Reference beat data, the list view cell that displays the data will be grayed.

Data Reduction

A data reduction window will be created for each group that has data reduction enabled. Each channel's beat data is used to calculate the data reduction output. If a cycles logging mark falls within a data reduction interval, the cycles derived output will be included in the data reduction calculations. Standard Deviation derived parameters (from the derived parameter window) will be reported as x's for data reduction.

Averaging

The analysis modules specify how each derived parameter should be averaged. Supported averaging types are listed below:

Mean

All beat derived data that fall within the logging interval are averaged together.

Harmonic Mean

The reciprocals of the beat derived data are averaged together and the reciprocal of the result is reported.

Max

The maximum beat value that occurs within the logging period.

Min

The minimum beat value that occurs within the logging period.

Sum

The sum of all beat derived data that fall within the logging interval.

Max Times

The beat value that occurs most often within the logging interval.

Most Recent

The last beat data to be included in the logging interval.

Analysis

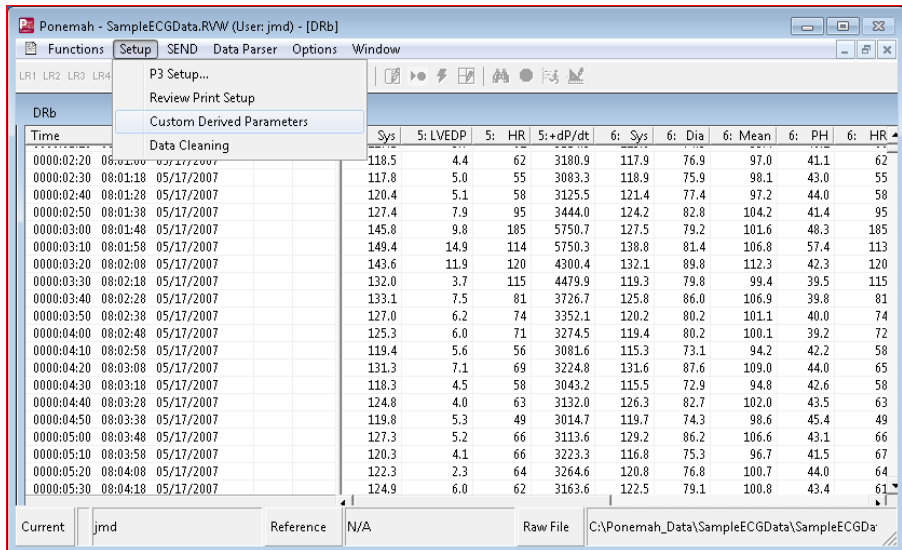
The Review requests the analysis to perform the average for these parameters, see Analysis Manual.

Custom Derived Parameters

Custom Derived Parameter is a tool within Review (not available during acquisition) to create additional derived parameters/end points by performing operations on the derived parameters that are already calculated within Ponemah.

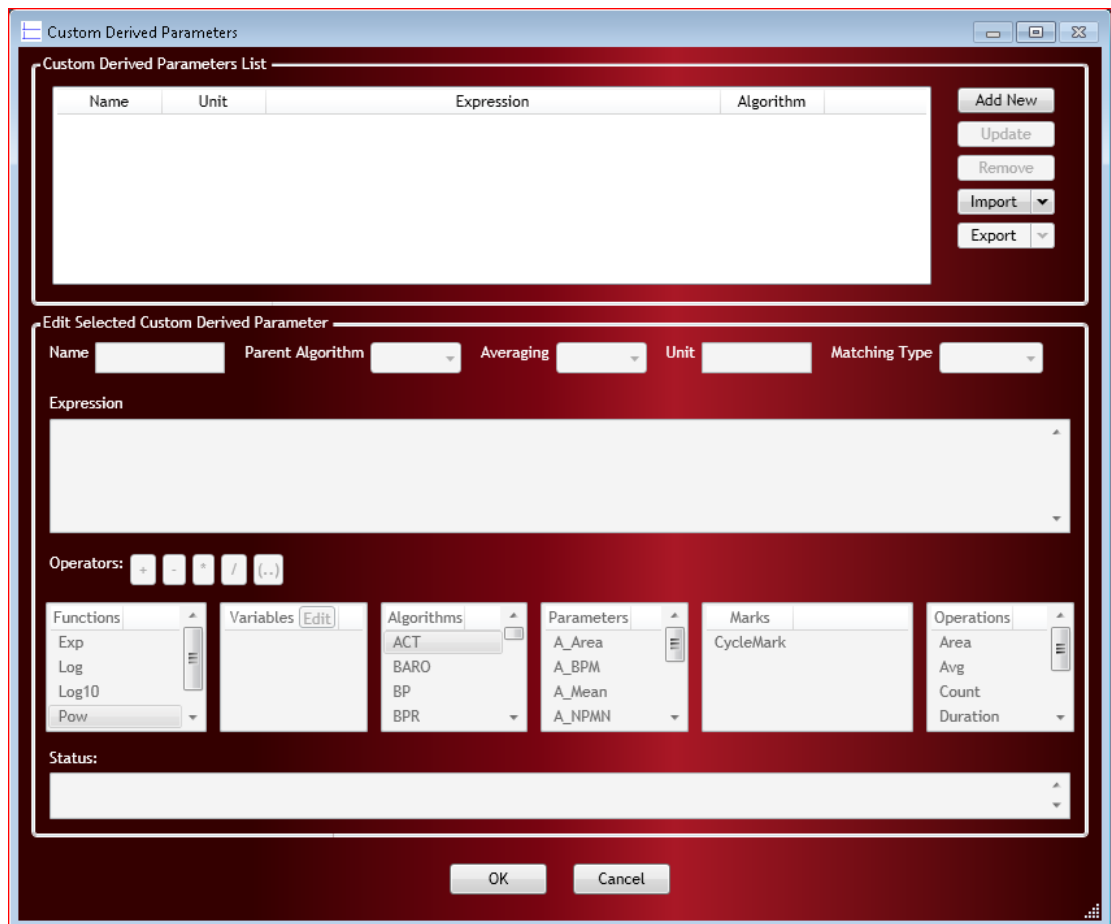
Launching Custom Derived Parameters

Custom Derived Parameter is accessed from the **Setup** menu.



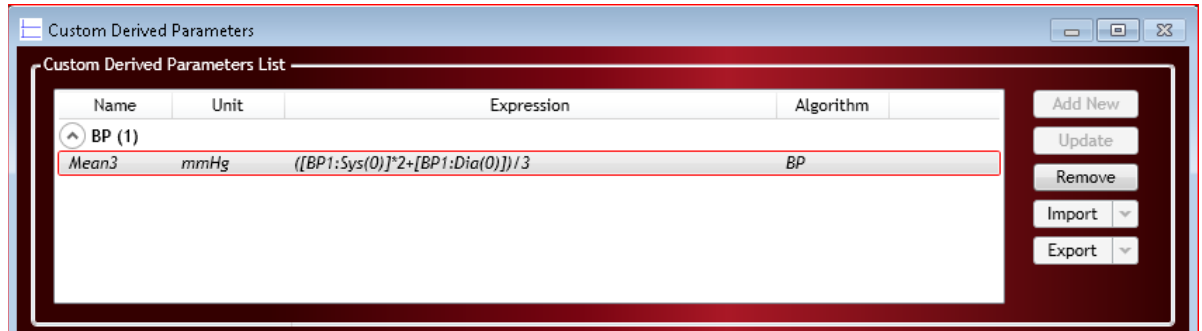
Custom Derived Parameter Dialog

After selecting **Custom Derived Parameters** from the **Setup** menu, the dialog below is displayed allowing configuration of the custom derived parameter.



The dialog is divided into two sections, **Custom Derived Parameters List** and **Edit Selected Custom Derived Parameter**.

Custom Derived Parameters List



The **Custom Derived Parameters List** section displays all custom derived parameters, sorted by Parent Algorithm. The Name, Unit, Expression, and (Parent) Algorithm are listed in the table list. The following buttons are in the left side of the Custom Derived Parameters List:

- **Add New:** Click to create a new custom derived parameter.
- **Update:** Click to update the selected custom derived parameter after making changes in the **Edit Selected custom derived parameter** section. Changes to custom derived parameters will not be saved automatically; update must be selected.
- **Remove:** Click to remove the selected custom derived parameter.
- **Import:** Click to import a custom derived parameter definition(s) from a comma separated variable (CSV, *.csv) file.
- **Export:** Click to export the selected custom derived parameter definition(s) to a comma separated variable (CSV, *.csv) file.

Edit Selected Custom Derived Parameter

The **Edit Selected Custom Derived Parameter** section is used to define the new derived parameter.

Defining Custom Derived Parameter

The custom derived parameter will need to be defined by entering information in the following field

- **Name:** Type in an appropriate name. Note that if a name is entered in this field that is already a name used with in Ponemah’s default derived parameters, the Status window will display the following error message:



- **Parent Algorithm:** Select the analysis module/algorithm that the newly created derived parameter should be associated with for enabling, disabling, and viewing.

- **Averaging:** select the default calculation to be performed on the range of cycles selected
 - **Harmonic Mean** - The reciprocals of the beat-to-beat derived data are averaged together and the reciprocal of the result is reported.
 - **Last** – The value of the last cycle in the logging period.
 - **Max** - The maximum value of all cycles occurring within the logging period.
 - **Mean** – The arithmetic mean of values for all cycles within the logging period.
 - **Min** - The minimum value of all cycles occurring within the logging period.
 - **None** – No averaging method will be performed on the cycle data, only on the averaged data. Note: data will not be impacted when performing data cleaning on cycle data (see section on Data Cleaning)
 - **Sum** - The sum of values for all cycles within the logging period.
- **Unit:** Enter the units the custom derived parameter should be reported with.
- **Matching Type:** When performing cross-channel calculations, the match type will be used to determine with cross-channel cycles correspond to one another for the calculation. Options are closest, preceding (use the secondary channel cycle that precedes the parent channel cycle) or following (use the secondary channel cycle that follows the parent channel cycle).
- **Expression:** The expression to calculate the newly defined customer derived parameter is entered in this field. The expression box can be entered by manually typing it or by using the Operators shown below the Expression Field. The expression can include the use of derived parameters from different analysis modules and use a range of cycles up to 10 cycles prior to or following the current cycle.

Expression Building

Expression building can be done by double clicking the Operators buttons or items from the pre-defined lists.

OPERATORS



Addition



Subtraction



Multiplication



Division



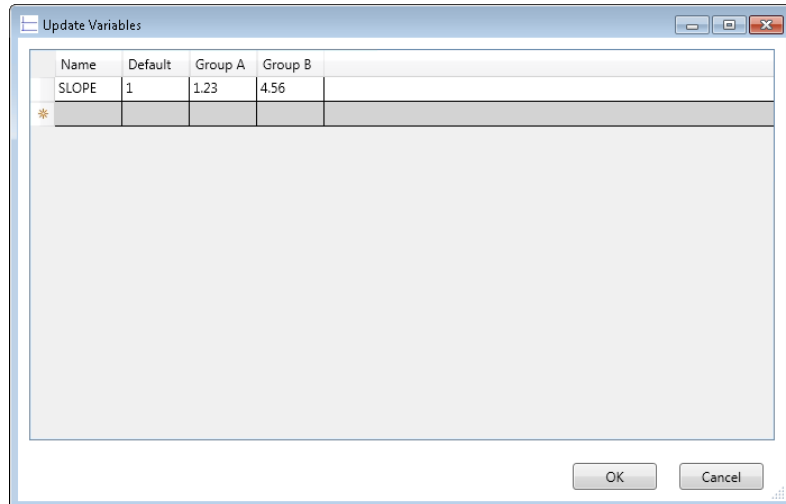
Parentheses

FUNCTIONS

- **Exp** – The natural exponential function: $f(x) = e^x$
- **Log** – The natural logarithm function with a base of e: $f(x) = \log_e(x) = \ln(x)$
- **Log10** – The logarithm function with a base of 10: $f(x) = \log_{10}(10)$
- **Pow** – The exponential function (raise to the power of): $f(x) = a^x$
- **Sqrt** – The square root function; $f(x) = \sqrt{x}$

VARIABLES

Variables can be defined on a per subject basis to permit a more sophisticated equations to be written and applied across the subjects in the study. To define variables, click the Edit button next to the Variables header. When prompted, a name for the variable should be entered along with the value to use for each subject. A default value must be entered to permit initial execution of the custom parameter. Once known, subject-specific values can be entered into the cell whose column and row are associated with the desired subject and variable, respectively. If using the Scatter graphs' Linear Regression function, values for slope and intercept can be copied to any of the variables defined in this dialog (see Scatter Graph Page section for more information).



ALGORITHM, PARAMETERS, MARKS

Expressions may be built using derived parameters, either default or custom, or cycle marks. Selecting the Analysis Module in the Algorithm list with update the Parameter and Mark list to display associated values. Double clicking the Parameter or Mark of interest will add it to the expression with the proper syntax.

OPERATIONS

- **Area** – Calculated the Area using the specified values selected
- **Avg** – Calculate the average using the specified values selected
- **Count** – Count the number of cycles using the specified range
- **Duration** – Calculate the time, in seconds, using the specified range
- **Max** – Calculate the maximum value using the specified values selected

- **Min** – Calculate the minimum value using the specified values selected
- **SD** – Calculate the standard deviation using the specified values selected

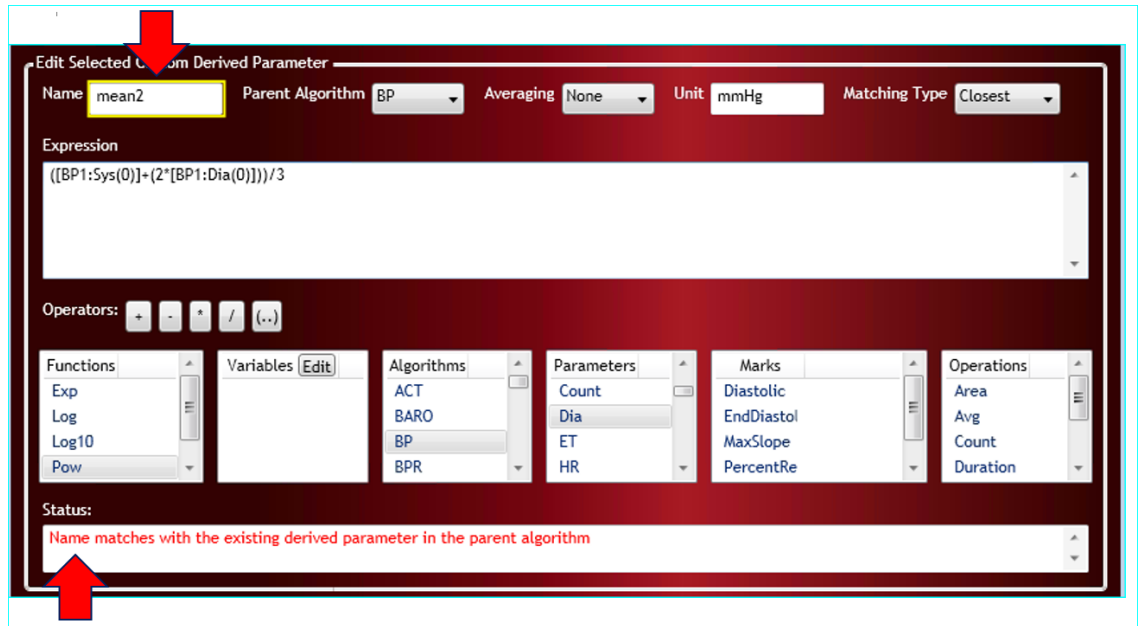
MANUAL EXPRESSION BUILDING

The user may manually enter the Functions, Variables, Algorithm, Parameters, Marks, and/or Operations without having to select them from the drop-down list or clicking a button. The use of [] are required when building expressions using parameters or marks from a different analysis module from the one selected in the Parent Algorithm field. Also the use of [] are required when referencing cycles other than cycle 0 (current cycle of interest) or for names with special characters or numbers (e.g. RR-I). An example below shows the use of [] to specify the <channel>:<derived parameter><(cycle#)>).

```
Expression
((BP1:Sys(0))+(2*[BP1:Dia(0)]))/3
```

Status Window

The status window in the bottom of the custom derived parameter dialog will alert the user to any errors found in defining the expression. If an error is present, the text in the Status field will be red, the Update button will be greyed out, and the Custom Derived Parameters List will have a red box around the custom derived parameter with the error. In addition, a yellow box will outline the field that the error lies. The example below shows the error message in the Name field.



Reporting Custom Derived Parameters

The custom derived parameters will be listed as a Derived Parameter at the bottom of the Derived Parameter list of its Parent Algorithm. Once selected as a derived parameter to report, the Derived List and Data Reduction List views will update to include a column for the custom derived parameter. The custom derived parameter column will be greyed (as seen in the screenshot below). Custom derived parameters

will not be calculated from data that are within bad data mark regions. Note: Custom Derived Parameters will be reported after all other default derived parameters are calculated.

DRa				1: Sys	1: LVEDP	1: HR	1: dP/dt	2: Sys	2: Dia	2: Mean	2: PH	2: HR	2: mean3
Time	EVT	Alar...											
0000:00:10 07:58:58 05/17/2007				121.0	4.4	70	2895.3	123.8	90.0	107.9	33.8	69	168.8
0000:00:20 07:59:08 05/17/2007				121.0	5.1	84	2994.6	122.3	88.5	105.8	33.8	84	166.6
0000:00:30 07:59:18 05/17/2007				112.9	3.8	89	3212.2	111.5	76.0	95.1	35.5	89	149.6
0000:00:40 07:59:28 05/17/2007				123.0	4.4	74	3093.1	125.6	90.1	108.5	35.5	74	170.6
0000:00:50 07:59:38 05/17/2007				115.7	4.1	76	3113.4	116.7	82.6	99.9	34.1	77	158.0
0000:01:00 07:59:48 05/17/2007				114.8	3.2	77	3240.5	115.6	81.1	99.6	34.5	77	156.2
0000:01:10 07:59:58 05/17/2007				116.1	3.4	74	3118.7	117.7	83.8	102.1	33.9	74	159.6
0000:01:20 08:00:08 05/17/2007				113.2	4.2	68	2976.3	113.9	79.3	97.9	34.6	67	153.5
0000:01:30 08:00:18 05/17/2007				116.5	3.7	70	3085.9	118.4	84.4	102.2	33.9	72	160.6
0000:01:40 08:00:28 05/17/2007				111.0	3.6	68	3027.1	111.7	77.7	95.4	34.1	67	150.6

Graphical Data Manipulation

A number of methods are available to navigate, search, and work with the graphical data. Graphical data are displayed in either Primary or Trend graph pages. Primary graph pages are used to display presentation signals (e.g. the input signal, derivative, difference, etc). Trend pages are used to graphically chart derived parameters.

Review Cursor

A cursor is available in each graph page and is represented by a vertical black line that spans all display panes in the graph page. A cursor may be positioned by left clicking with the mouse in a display pane. A cursor may also be positioned by using the left/right arrow keys. Use of the arrow keys will result in the cursor moving by one sample or one pixel, whichever is greater. Time information at the cursor location is displayed in the ET (Elapsed Time) field in the bottom left corner of the graph page. Sample information at the cursor is displayed in the bottom left corner of each display pane. The min/max value at the cursor is reported.

Selected Display Pane

Only one display pane in a graph page is the selected display pane. A border is drawn around the text in the label area for the selected display pane. Keyboard input and search functions are applied to the selected display pane. A display pane is selected by clicking in the display pane or in its label area. Alternatively the selected display pane may be changed by using the up/down arrow keys.

Scaling

X axis, Time/Samples Per Pixel

Double clicking on a display pane will display a dialog that permits the user to set the X axis scaling for the entire graph page and to switch between *Time* and *Samples Per Pixel* modes. When in *Time* mode, the time that corresponds to the graph page width is specified. When in *Samples Per Pixel* mode, the user specifies the number of samples that should be displayed per pixel, and this relationship is maintained if the size of the graph page is modified.

Y axis and AutoScale

Double clicking on a display pane will display a dialog that permits the user to set the Y axis scaling and to AutoScale the Y axis. Clicking on the **AutoScale** button

will set the high and low Y axis edit fields to the upper and lower limits of the trace currently displayed in the display pane.

View Entire Data Set

This tool bar and menu item displays the entire data set in the graph page. This selection is useful to obtain an overview of the entire acquisition by observing the signal envelope and to zero in on regions of interest by using the Zoom feature. It is recommended that validation marks be turned off when using this feature to permit viewing of the signal envelope.

Expand, Compress, and Snap Zoom

Additional methods of adjusting the X axis have been provided for ease of use. Expand and Compress tool bar and menu selections expand and compress data about the cursor, keeping the data at the cursor fixed. An accelerated expand and compress is achieved by keeping the Ctrl key pressed while clicking on the expand/compress button.

Selecting the Snap Zoom In tool bar/menu item enters Snap Zoom In mode and changes the mouse cursor to crosshairs. While in this mode, the user can zoom in by clicking the left mouse button at the start of the region of interest and releasing it at the end of the region of interest. On releasing the left mouse button the selected region will be expanded to fit the graph page. NOTE: If the start point is free of marks, the same result can be achieved without first selecting the tool bar/menu item.

Selecting the Snap Zoom Out tool bar/menu item enters Snap Zoom Out mode and changes the mouse cursor to crosshairs. While in this mode, the user can zoom out by clicking the left mouse button at the start of the region of interest and releasing it at the end of the region of interest. On releasing the left mouse button the data currently displayed in the graph page will be compressed to fit in the selected region. NOTE: If the start point is free of marks, the same result can be achieved without first selecting the tool bar/menu item and by holding down the Ctrl key.

Moving through the data

Scroll Bar

Each graph page includes a horizontal scroll bar that provides a representation of the data currently being viewed, relative to the entire data set. The scroll bar may be used to view different portions of the data. Clicking on the left/right arrow moves the data by a tenth of the Axis time. Clicking on the scroll bar to the left/right of the bar moves the data by a page. The bar may be dragged to move through the data as well.

Page Up and Page Down

The **Page Up** and **Page Down** keys page through the data. **Page Up** moves forward in time and **Page Down** moves back in time.

Search Functions

Search capabilities have been provided to search for the next/previous Mark, Change Marker, Note, Event, unmatched cycle (Template), bad data mark, and for searching by Time. These search functions are directed towards the selected display pane in a graph page.

Searching for Change Markers, Notes, Events, Time, unmatched cycles, and bad data marks have corresponding tool bar/menu items. Searching for the next mark is achieved using the Tab key, previous mark, by using the Shift-Tab key.

NOTE: If the Shift key is pressed when selecting search for events, a dialog with available events will be displayed, permitting selection of a specific event.

Copy

Graphical data may be copied for use in reports. Individual display panes may be copied or an entire graph page may be copied. To copy a waveform image, right click in the label area of the display pane/graph page to be copied. Select **Copy Entire Graph Page Image** to copy the graph page. Select **Copy Selected Channel Image** to copy the display pane.

Sync

The graphical and derived data can be synchronized with each other as follows:

Synchronizing the Derived Data with the Graphical Data

Position the Review Cursor at the point of interest and ensure that a display pane belonging to the channel to be synchronized is selected. Select the **Synchronize with Derived Data** tool bar button/menu item. The derived and data reduction window(s) will be adjusted to bring the associated data into view.

Synchronizing the Graphical Data with the Derived Data

In order to view the graphical data that was used in the calculation of derived data or data reduction information, double click on the line of interest. All graph pages that contain the channel that was double clicked on will be adjusted to bring the associated data into view. If one of the non channel columns is clicked on (time, event, or alarm) all graph pages will be adjusted.

Review may be instructed to rescale the time axis when syncing by selecting *Review: Rescale Graphs on Double-Click* in the *Settings* page in the *P3 Setup* dialog. The setting may be inverted by holding down the *Alt Key* when double clicking to Sync. The following paragraphs assume that the rescale option is enabled.

When a derived data window is clicked on, affected primary graph page's time axes will be scaled and the relevant data range will be scrolled into view. Trend graphs will not scale their axes but will scroll data into view as follows: If the time range associated with the line of derived data fits on the trend graph page, it will be centered on the graph page. If not, the start of the time range will be set to the left edge of the graph page.

When data in a data reduction window is clicked on, associated primary and trend graph page's time axes will be scaled and the relevant data range will be scrolled into view. The time range used is the time associated with the data reduction interval/control interval that is clicked on.

Waterfall Plots

Waterfall plots allow researchers to easily assess waveform morphology for changes using a 3-dimensional visualization to display waveform cycles or averaged cycles over time. Many researchers use Waterfall plots as a method to easily confirm treatment-induced waveform morphology changes. For example, assessing ECG signals for QT-interval or PR-interval prolongation or changes in P and T heights. Though often used with ECG signals, Ponemah Waterfall plots may be used across any signal type and presentation to assess changes; e.g. assessing changes in upstroke of LVP signal to visualize changes in $+dP/dt$.

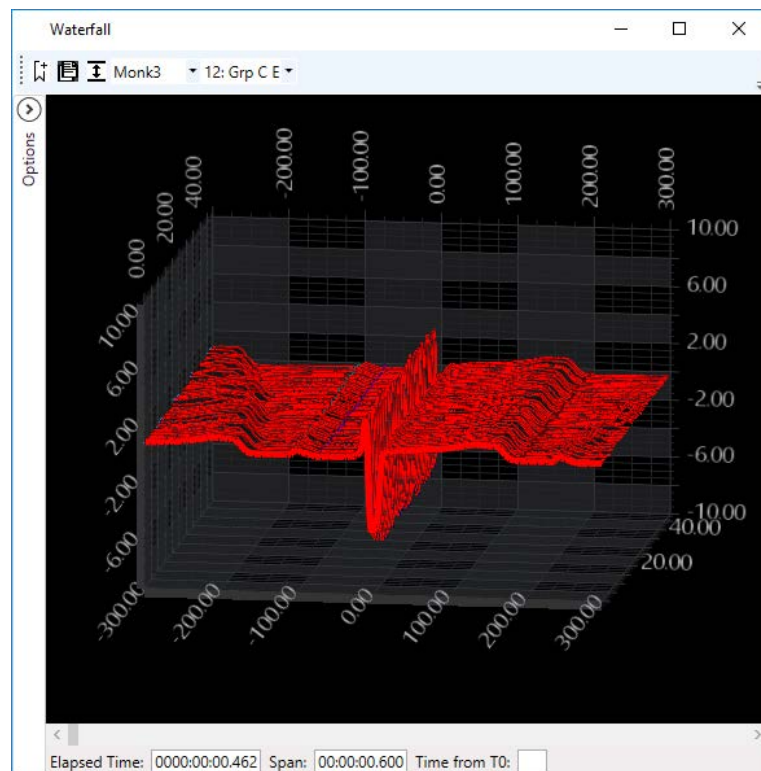
This visualization tool may then be used in presentations or posters to help highlight changes using a visual to elucidate a point more easily.


Waterfall Plot Setup


Waterfall plots are a Review Only feature and are accessible from the Functions menu. All active channels loaded into Review will be available for use with Waterfall plots.

To configure a Waterfall plot:


1. Open the desired Review (.RVW) file
2. Select Functions | Waterfall View
3. By default, the first Channel of the first Group will be displayed:




4. Expand the Options using the arrow  to access the configuration settings

5. Expand Data Selection using the arrow  to define the desired data to display in the Waterfall plot

Data Selection Field	Description
Subject	Permits selection of the Ponemah Group/Subject to display in the Waterfall plot. A dropdown is available from the tool bar to easily switch between Groups/Subjects.
Input	Lists the available input channels from the Group/ Subject selected. Select the desired channel to display in the Waterfall plot. A dropdown is available from the tool bar to easily switch between input channels.
Presentation	Lists the presentation signals available from the channel, e.g. ECG or its Derivative.
Anchor Mark	Lists all available fiduciary marks from the analysis module defined to the Input channel. The anchor mark is used for Waterfall Segment alignment, e.g. if R Wave is defined as the anchor mark, all Waterfall Segments will align to the R mark to 0.00 on the time axis.
Time Before (ms)	Defines the amount of time, in milliseconds, displayed in the Waterfall plot prior to the Anchor Mark.
Time After (ms)	Defines the amount of time, in milliseconds, displayed in the Waterfall plot after the Anchor Mark.
Averaged Samples	<p>When unchecked, the Waterfall plot will display beat data for the number of Waterfall Segments and Display Interval defined.</p> <p>When checked, the Waterfall plot will display averaged cycles over the Logging Rate defined for the number of Waterfall Segments and Display Interval defined.</p> <p>The role Averaged Samples plays with Parser Segments is defined below.</p>
Parser Segments	<p>If Data Parser Segments are defined and this setting is checked, the Waterfall plot will only display Waterfall Segments within the Data Parsers.</p> <p>When Averaged Samples is unchecked, the Waterfall plot will display beat data contained within the Parser Segment for the number of Waterfall Segments and Display Interval defined. In this mode, the transition from one Parser Segment to another is indicated by a change in Waterfall Segment trace color, which you may define in the Appearance settings.</p> <p>When Averaged Samples is checked, the Waterfall plot will display a single, averaged cycle for each Parser Segment defined.</p>
Waterfall Segments	A single Waterfall Segment may be an individual cycle or an averaged cycle. This setting permits definition of the number of Segments displayed by the Waterfall plot. Valid range is 2 – 200.
Display Interval	<p>When assessing data over large amounts of time is required, the Display Interval may be used to define how often Waterfall Segment should be displayed. For example, using a Display Interval of 1 would result in the Waterfall plots displaying every Waterfall Segment, while a Display Interval of 2 would display every 2nd Waterfall Segment.</p> <p>Example of Scale: If the Logging Rate is 1 minute, Averaged Samples is checked, the number of Waterfall Segments is 60, and Display Interval is 1, then you will effectively see 60 minutes (1 hour) of data displayed in the Waterfall Plot. Updating the Display Interval to 5 would result in the Waterfall plot displaying every 5th Segment and provide a broader view of the dataset, as now the 60 Waterfall Segments displayed is across 300 minutes (5 hours).</p>

6. Expand Appearance using the arrow  to define the background and trace colors

Appearance Field	Description
Background Color	Defines the background color to display behind the axes and signal traces.
Trace Color	Defines default color of the Waterfall Segment trace.
Trace Color 2	When using Parser Segments with Averaged Samples unchecked to display beat data within Data Parsers, Trace Color 2 is used to define the alternating Parser Segments. This helps to provide a clear indication of Data Parser Segment boundaries and inform the user as they move between Parser Segments.
Y Axis Max/Min	A Y-axis Auto Scale icon is available from the toolbar  . However, these settings permit the user to set finite y axis limits.
Color relative to T0	Permits users to define the Trace Color by time range relative to the T0 Event defined in Data Reduction to help indicate relative data position when assessing for treatment effect. Start time and End times are relative to the T0 event and are in hh:mm:ss format. Start time of 00:00:00 indicates Trace Color will start at the T0 Event.

Using Waterfall Plots

Now that your Waterfall plot is configured, let's discuss using the plot to navigate through your data and capture any findings.

Data Navigation

Use the scroll bar at the bottom of the graph to navigate through your data. The following time elements are listed under the scroll bar to help indicate display location of the Waterfall plot in context of the entire loaded data set.

Field under Scroll Bar	Description
Elapsed Time	The Elapsed Time associated with the first segment displayed in the Waterfall plot is listed under the scroll bar in hhhh:mm:ss.sss format. Selecting a specific Waterfall Segment within the plot will bold the Segment and update the Elapsed Time to display the time associated with that Segment.
Span	The time span of the Waterfall Segment displayed in hh:mm:ss.sss format.
Time from T0	If Data Reduction is defined and the associated T0 Event is placed, the Time from T0 will be displayed in hh:mm:ss.sss format.

Data Synchronization


Buttons/Mouse Click	Function
<Alt> + <s>	Will synchronize the Ponemah Derived List Views and any configured graphs to the selected Segment within the Waterfall plot When in a primary graph or trend graph will also synchronize any associated Waterfall plots.
Mouse Scroll	Navigate through the data

<Shift> + Mouse Scroll	Rotate the plot
<Ctrl> + Mouse Scroll	Zoom

Graphical Display

Use the mouse scroll wheel to zoom in or out of the display.


Hold <Ctrl> + mouse Left click-and-drag to rotate the graph axes and obtain the ideal view. For more fine control of graph display and positioning, expand the Options | Advanced display settings to access:

Advanced Field	Description
Trace Thickness	Field entry or slider bar control of the trace drawing line weight. 
Opacity	Field entry or slider bar control of trace drawing line transparency.
Up/Down	Field entry or slider bar control of graph rotation up or down, relative to the current viewing presentation angle.
Left/Right	Field entry or slider bar control of graph rotation left or right, relative to the current viewing presentation angle.
Show Axes	Permits users the ability to toggle on/off the graph axes.

Bookmarks

Bookmarks provide a method of capturing a data segment of interest for quick, easy access back to that area at any time and from anywhere in the recording. Once added, a bookmark will save the time range of the displayed data, the defined Data Selection settings, and Appearance at time taken. Bookmarks allow users to easily compare Waterfall plots of different data segments.

Adding Bookmarks:

1. Navigate to the desired area of interest.
2. Click the  icon from the toolbar.
3. Update the Bookmark name by left-clicking the default name and replacing it with the desired text.
Default name is Group/Subject Name and Data/Time of Bookmark creation.

Opening Bookmarks:

1. Select the desired Bookmark from the Bookmarks list.
2. Click Open button.

A new Waterfall plot window will open displaying the original Waterfall plot content/setting as defined at Bookmark creation.

Making Changes to Bookmarks

Any changes made to the resultant Waterfall plot window, as opened from the Bookmark will not alter the original Bookmark settings stored. To save the new setting, a new Bookmark will need to be added.


Deleting Bookmarks:

1. Select the desired Bookmark from the Bookmarks list.
2. Click Delete button.

Saving Bookmarks

Any Bookmarks added or deleted during the Review session will be saved upon selecting Functions | Save Review Protocol or Save Marks Section.

Export Waterfall Plot

Waterfall plots may be copied from the Ponemah Waterfall plot display and pasted into third party presentation tools like PowerPoint. To do this, click the toolbar's Copy icon , then paste it into the desired third-party tool.

Marks

Marks generated during acquisition/replay are stored in the *Analysis* marks section. Changing signal interpretation attributes during the course of acquisition or replay will not affect the position of marks that have already been generated.

Note:	Jumping back during a Replay will result in loss of all marks.
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Display of marks in a graph page is controlled by the Toggle Validation Marks tool bar button/menu item. Marks can also be controlled on a mark by mark basis through the analysis attributes dialog box. Positioning the mouse cursor over a mark will identify the mark in the *ID Text* field at the bottom left of the graph page. Each analysis identifies one of the marks in a cycle as the logging mark, this is the mark with which the cycle number is associated, and the time at the logging mark is used to record the cycle's derived data when in epoch mode.

Moving a Mark

Certain marks can be moved when the mouse cursor is positioned over these marks; it changes from a pointer to an east-west arrow. A mark can be moved by clicking the left mouse button and dragging the mark to a new location. On repositioning the mark the associated derived output will be recalculated. When a mark is moved a yellow change marker along with a dashed line is placed at the original location. Some marks are calculated marks whose positions are determined by the location of other marks and by waveform characteristics. These marks cannot be moved.

Marks cannot be moved past other marks, bad data marks, or segment boundaries.

Right clicking on a moved mark will present **Undo Move** as one of the menu options. Selecting **Undo Move** will return the mark to its original location and will

remove the change marker. Alternatively the mark could be repositioned manually. If any other marks interfere with the return of the moved mark, **Undo Move** will not be present in the right click menu.

Note:	Certain features will not be available if Enable Difference Calculations is disabled in the Review dialog. This is accessed through the Application Configuration dialog from the Tools pull down menu. This feature is meant to enhance system performance when dealing with very large files. Features not available include Toggle Mark Differences, Search Previous/Next Change and Undo Move features. Additionally, any changes to the derived data will not be displayed (cells grayed) when this feature is disabled and N/A will be displayed for the reference name on the main Ponemah window.
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Deleting/Inserting a Mark

Right clicking in a display pane will bring up a number of options. Among them are deletion/insertion options that are valid at the selected point. In order to delete a mark the mouse cursor should be positioned over the mark before bringing up the right click menu. To delete a cycle, position the mouse cursor over the logging mark. Some analysis modules permit deletion/insertion of certain marks while some analysis modules only permit insertion/deletion of cycles. Please refer to the analysis module manual for more information. When a mark or cycle is inserted the new mark is tagged with a green change marker. When a mark or cycle is deleted, the deleted marks are drawn with dashed lines and are tagged with red change markers.

Events

All events created in acquisition are available during a Review session. Placing the mouse cursor over an event will display its text string in the **ID Text** field in the lower left corner of the graph page. Events can be added and deleted while in Review mode. To add an event, right click at the point where the event should be inserted and select **Add Event** from the right click menu. To delete an event, position the cursor over the event, right click, and select **Delete Event** from the right click menu. Events can also be moved by clicking on them and dragging them to a new location.

If Data Reduction is triggered off an event that is added, deleted, or moved, the Data Reduction output will be updated.

If an event is double-clicked on in the **Events** list view, every graph will move to the appropriate time.

The **Events** list view has the sort capability. If the column headers are clicked on, all of the information within the list view will be sorted based on that column and the direction of the arrow in the column header.

Bad Data Marks

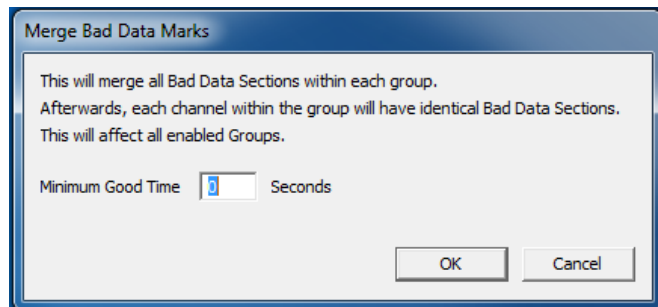
Bad data marks enable the user to eliminate small sections of noisy or erroneous data from calculations. Inserting bad data marks results in the insertion of 2 dashed

burgundy lines, a start and end, as reflected in the hover status bar. Bad data marks are inserted/deleted using the right click menu and may be moved by dragging a start/end bad data mark. Bad data marks may be introduced anywhere in the data as long as they do not span an existing bad data mark or data break or are placed within a bad data region. If bad data marks are inserted within a cycle, the cycle will be deleted. If bad data marks are inserted between two cycles, no cycles will be deleted. If a bad data mark is moved within a cycle, the cycle will be deleted.

Introducing bad data marks does not remove the enclosed data, just the marks associated with the data and it ensures that the bad data are not used in derived parameter calculations.

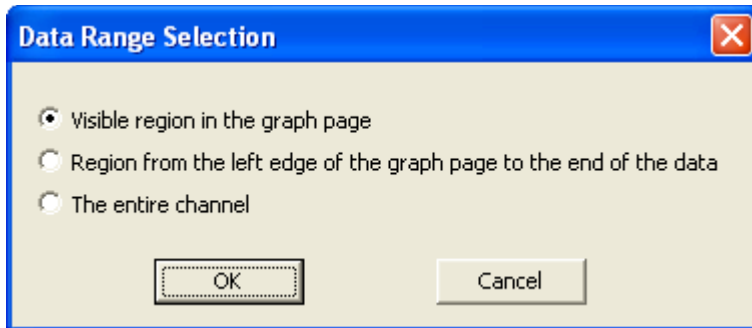
Merge Bad Data Marks

The Bad Data Mark Merge feature button can be accessed from the Review Functions menu. When selecting the Merge Bad Data Marks option under the Functions menu, the following menu appears. Enter the Minimum Good Time and select OK. Ponemah will merge all bad data mark sections within a group, such that all group channels will have identical bad data mark sections. If new bad data marks are placed within any channel after the button has been pressed, these will not be applied across all channels within the group. The button should be pressed again to merge any newly added bad data marks across the associated group channels. The **Minimum Good Time** defines the upper limit of the time interval between bad data marks to determine if the bad data marks sections should be marked as a single section or marked separately. The default time is 10 seconds. This will affect how data is reported by Group in the Derived Data and Data Reduction outputs.



PPP3 Setup Dialog Settings Review Mode Group For Bad Data Marks

If the user right clicks on a bad data mark the option **Delete Bad Data Marks - Single** appears. This allows the user to delete the current bad data marks. If the user right clicks on a bad data mark or anywhere else on the graph the option **Delete Bad Data Marks - Range** option appears. This will bring up a dialog on which bad data marks will be deleted. The dialog is shown below.



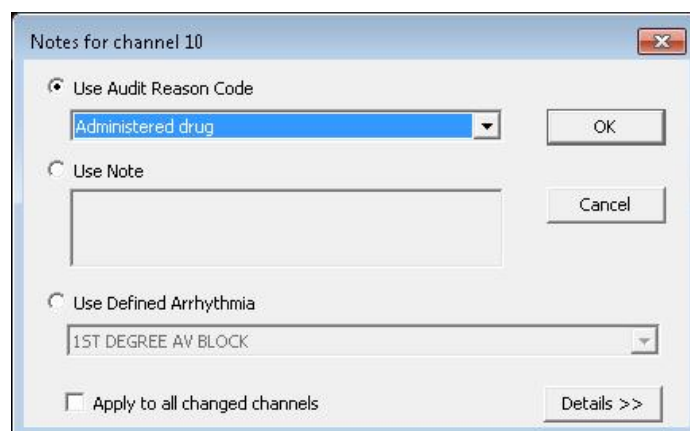
The user has three options. If **Visible region on the graph page** is selected, all of the bad data marks from the current graph page view will be deleted. If **Region from the left edge of the graph page to the end of the data** is selected, all of the bad data marks from the left edge of the graph page to the end of the data will be deleted. If **The entire channel** is selected, all bad data marks from the entire channel will be deleted.

There is a button on the tool bar of the graph page called Toggle Bad Data Marks. By default, the button is enabled, which will show all bad data marks in the graph. When disabled, the visible marks will disappear, however all data within the marks will remain excluded from derived parameter calculations. Bad Data Marks can also be toggled on and off through the Options menu in the graph page by selecting **Draw Bad Data Marks**.

When disabled, the only options the user will have from the right-click menu will be **Add Bad Data Mark**, and **Delete Bad Data Marks - Range**. Adding bad data marks here will remain invisible until the option has been enabled again. **Delete Bad Data Marks - Single** will still be available when the marks are enabled.

Freeform Notes

Freeform notes are supported in Review and may be placed anywhere in a display pane. Notes are added and deleted using the right click menu when in a Primary Graph Page.



The user can add a freeform note using one of 3 options:

1. Audit Reason Codes: Text pre-defined in the Audit Reason Codes List (Options>Audit Reason Codes, See P3 Plus Reference Manual).
2. Note: Free text field

- Use Defined Arrhythmia: a dropdown list that presents options defined in the SEND Controlled Terminology Manager (in idle Mode, click on SEND> Controlled Terminology) under ECG Results Sections. The default list comes from CDISCs ECG Results Terminology, but can be edited by users.

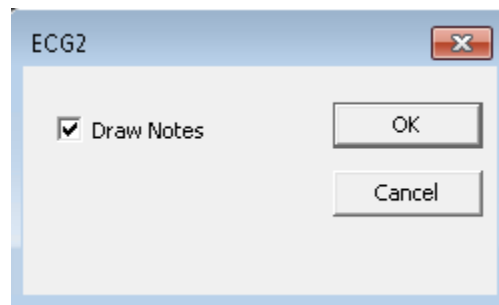
Freeform notes can be applied to one or all channels by selecting or deselecting the Apply to all changed channels checkbox at the bottom of the Notes dialog box.

Search & Displaying Freeform Notes

Freeform Notes can be searched for by using the “Search For Next Note” and “Search For Previous Note” icons in the toolbar.



The text associated with a note may be viewed by placing the mouse cursor over the note. Drawing of Notes for a display pane may be suppressed by selecting **Display Options** from the right click menu and disabling the check box.



Reanalyzing Data

Instead of moving marks manually, the user may instruct review to reanalyze a portion of the data or all the data in a channel. This is useful when dealing with data that exhibits a change in morphology that requires a modification to the attribute settings to accommodate the change.

To reanalyze a channel: Right click on the channel of interest and select **Analyze** from the right click menu. The analysis attributes dialog will be displayed with the current data in the waveform window. Adjust the attributes if necessary to ensure the analysis is triggering correctly and click on the **OK** button. The next dialog that is displayed is the **Effects and Scope of Changes** dialog which outlines the effects of the modifications to the attributes. Select the **Reanalyze** check box and select the range over which the analysis should be performed. On selecting **OK**, Review will reanalyze the signal. Changes to marks positions will be displayed and derived data will be recalculated.

Note:	Reanalysis may be performed without making any changes to analysis attributes. Reanalysis is performed whenever the Reanalysis check box in the Effects and Scope of changes dialog is selected.
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The discussion so far assumes that the user is modifying attributes that deal with the interpretation of the signal (Signal Interpretation Attributes) however a number of other types of attributes exist and are described below.

Attribute Types

Analysis attributes deal with a number of distinct features such as, interpretation of the input signal, filtering, identifying associated channels, etc. The effects, on Review, of changing different types of attributes differs, with some changes only affecting the region to which they are applied and some affecting the entire signal or all marks sections. When changes are made to analysis attributes, the effects of these changes may be previewed in the **Effects and Scope of Changes** dialog, prior to putting the changes in effect.

Signal Interpretation Attributes

These are attributes that are used by the analysis to aid in the identification of cycles and in the placement of marks that are dictated by signal morphology. Such attributes are used during acquisition and replay to determine the placement of marks. Thereafter Review uses the marks positions rather than the attribute settings for its calculations. A user can request the analysis to reanalyze data using the displayed attributes. This requires the user to select the **Reanalyze** check box and specify the range over which the analysis should be performed, as described above.

Note:	Signal Interpretation attributes are the only attributes that require the Reanalyze check box to be selected in order to take effect. All other attributes take effect on selecting OK from the Effects and Scope of Changes dialog, whether or not the Reanalyze check box is checked.
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If a Signal Interpretation Attribute is changed, the following text will be displayed in the **Effects and Scope of Changes** dialog:

Signal Interpretation attributes changed:

The effects of these changes will be seen only if Reanalyze is selected. The modified attributes will be used to recalculate the location of validation marks and will replace existing validation marks over the range selected below.

Signal Conditioning Attributes

These are used to pre condition the input signal prior to analysis. This may be low/high pass filtering, conversion from a volume signal to a flow signal, subtraction of atmospheric pressure, inverting a signal, etc. During acquisition and replay, changes to these attributes affect future processing of the input signal. During review, the current setting is applied to the entire Review file.

The user will be notified that changes to these attributes may result in the invalidation of existing marks due to changes in the input signal.

Calculated marks will be recalculated following such a change. The derived parameters will automatically be recalculated.

If a Signal Conditioning Attribute is changed, the following text will be displayed in the **Effects and Scope of Changes** dialog:

Signal Conditioning attributes changed:

These changes affect all data in this channel and may result in the modification of the primary signal. If these changes are accepted, previously generated marks may be rendered invalid for this channel. Marks may be recalculated by reanalyzing the entire channel.

Calculation Attributes

These are attributes that are used to provide numeric input that is used in the calculation of some marks positions and some derived parameters. Examples include Percent Recoveries, etc. During acquisition and replay, changes to these attributes affect future calculations only. During review, the current settings are applied to the entire Review file.

Changes to such attributes will result in recalculation of all derived parameters and marks that depend on the attribute.

If a Calculation Attribute is changed, the following text will be displayed in the **Effects and Scope of Changes** dialog:

*Calculation attributes changed:
These changes will be applied to the entire channel and will result in the recalculation of marks and derived parameters that are dependent on Calculation attributes.*

Precision Attributes

These are attributes that are set in the precision tab. Changes to precision attributes will result in a reformatting of the channels values displayed in the derived parameter window(s).

If a Precision Attribute is changed, the following text will be displayed in the **Effects and Scope of Changes** dialog:

*Precision information changed:
The affected derived parameters will be updated.*

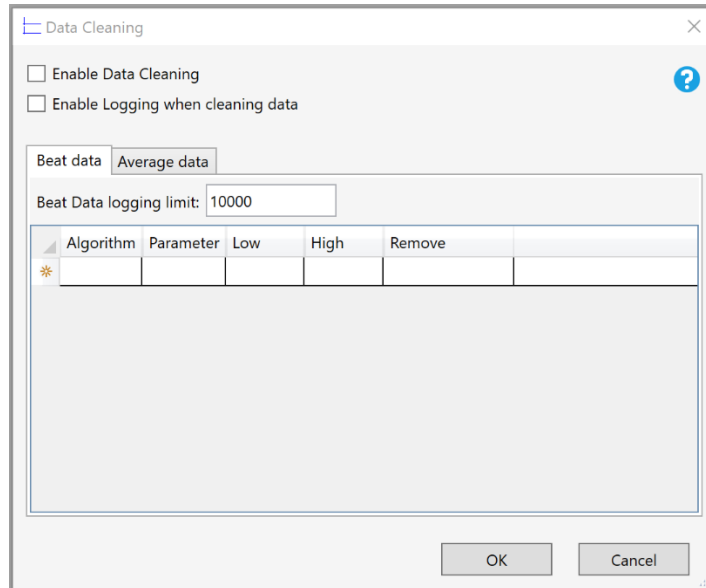
Redraw Attributes

These are attributes that if changed require a redraw of the graph pages. Examples of such attributes include filters, marks, cycle numbers, etc. If a Redraw Attribute is changed, the following text will be displayed in the **Effects and Scope of Changes** dialog:

*Redraw required:
These changes require a redraw of this channel.*

Data Cleaning

Data Cleaning is a feature that allows the exclusion of undesirable data in reporting outputs without manipulating the data set, e.g. adding bad data marks. The Data Cleaning feature can be accessed by selecting Data Cleaning under the Setup menu.



Data Cleaning Dialog

The Data Cleaning feature is deactivated by default. The **Enable Data Cleaning** check box activates this functionality.

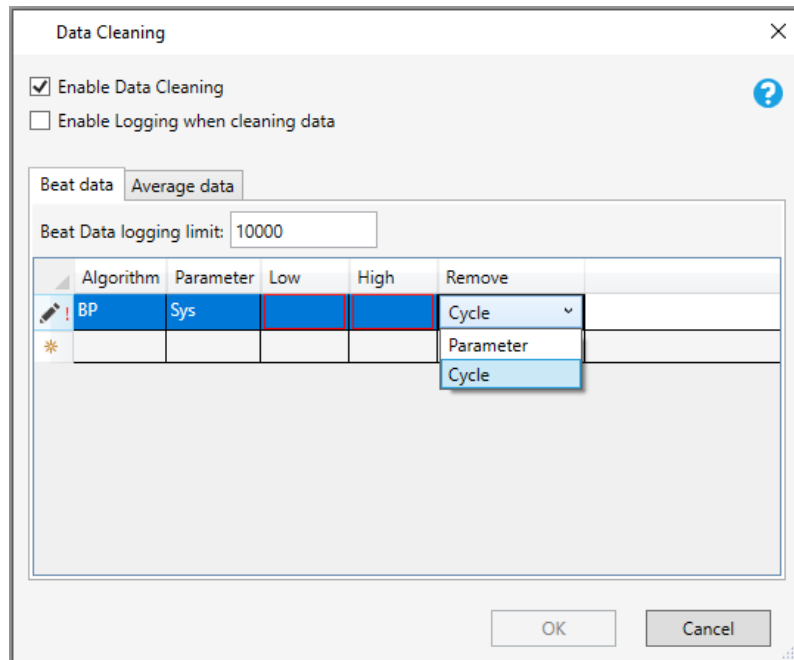
Enable Logging when data cleaning adds information to the log file for data that is removed from reporting by the Data Cleaning feature. This log appears in the excel output in a tab labeled Data Cleaning. It is possible for Logging to have an impact on calculation speed, so it is recommended to enable logging at the end of the data cleaning setup process to minimize any calculation speed reductions.

1	Time	Subject	Channel	Parameter	Level	Value	Limit	Reason	Remove
2	00:06:29	A - Group A	1 - (AoP)	HR	Average Data	37.19008	50	low value out of range	Interval
3	00:06:39	A - Group A	1 - (AoP)	HR	Average Data	44.08523	50	low value out of range	Interval
4	00:06:54	A - Group A	1 - (AoP)	HR	Average Data	43.92387	50	low value out of range	Interval
5	00:06:29	A - Group A	5 - (PAP)	HR	Average Data	37.75168	50	low value out of range	Interval
6	00:06:39	A - Group A	5 - (PAP)	HR	Average Data	44.02054	50	low value out of range	Interval
7	00:06:54	A - Group A	5 - (PAP)	HR	Average Data	43.57298	50	low value out of range	Interval
8									
9									

Data Cleaning Log in Excel Output

Data Cleaning can be performed on a beat-by-beat or average logged line level. Settings for each type of data can be entered by clicking on the **Beat data** and **Average data** tabs.

Data Cleaning – Beat Data



Data Cleaning Dialog – Beat Data

The **Logging Limit** sets a maximum number of data points to be included in the log file as a further prevention measure against slow performance resulting from enabling logging. The logging limit for Beat data when the Enable Logging when cleaning data check box is selected can be manually entered in the Beat Data logging limit text field.

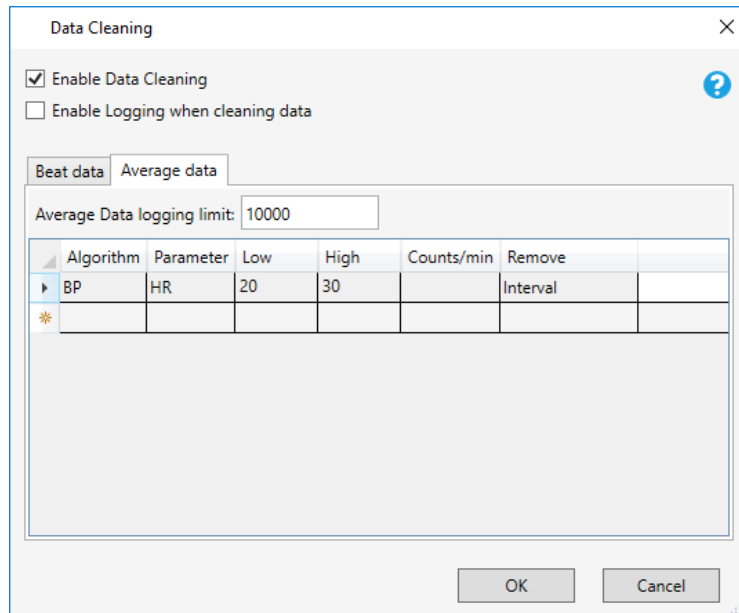
The **Algorithm** field defines the channel type to which the data cleaning will be applied; i.e. the data cleaning will apply to all channels with BP analysis associated.. By clicking in the **Algorithm** field, a drop-down menu will appear displaying multiple algorithm options, e.g. BP, ECG, etc. Select the appropriate algorithm for your data.

The **Parameter** field defines the parameter data cleaning will monitor against the low and high settings. By clicking in the **Parameter** field, a drop-down menu will appear displaying multiple parameter options, ex. Sys, Dia, etc. Select the appropriate parameter for your data.

The **Low** and **High** fields define the lower and upper value limits for acceptable data. Any cycle parameter value less than/equal to the designated **Low** or and greater than/equal to the **High** value will be removed from reporting. Type the desired **Low** and **High** values into their respective fields. Any fields missing required information will be outlined in red.

When the **Remove** drop-down menu is clicked, two options appear: **Cycle** and **Parameter**. This selection defines the action taken by the data cleaning function when a value falls outside of the low-high value range. **Cycle** will remove all derived parameter data associated with the cycle. **Parameter** will remove only the particular parameter for the offending cycle as specified in the Parameter field.

Data Cleaning – Average Data



Data Cleaning Dialog – Average Data

The Data Cleaning – Average Data dialog has many of the same fields as the Beat Data dialog. However, since this is dealing with averaged data, the following are also included:

The **Counts/Min** field defines the minimum counts/min criteria for data cleaning. Any data points less than the designated **Counts/Min** value will be removed from reporting. Counts must be entered in terms of a minute-based time measurement and in whole integers. Type the desired **Counts/Min** value into the Counts/Min field. If values are entered in the Low and/or High fields, this information is not required.

When the **Remove** drop-down menu is clicked, three options appear: **Subject**, **Interval**, and **Parameter**. This selection defines the action taken by the data cleaning function when a low or high value is encountered. **Subject** will remove all derived parameter data for any subject for which the low, high, or counts/min value occurred. **Interval** will remove all derived parameter data for any interval in which the low, high, or counts/min value occurred. **Parameter** will remove only the derived parameter data of the parameter specified in the Parameter box.

Once all settings have been entered/selected, click **OK**.

Protocol Information and Marks Sections

Each Review file contains a single copy of protocol information and contains at least one, possibly multiple, marks sections. A marks section contains the locations of marks, events, notes, and bad data marks. The protocol information determines the window positions, scaling, derived parameters that are selected, data reduction setup, logging rate, analysis attributes, etc.

Note:	Since a single copy of protocol information is available in a Review File, changes made to the protocol information affect all marks
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sections.

Saving a Marks Section

After changes are made to a marks section, it may be saved by selecting **Save Marks Section** from the **Functions** menu. On doing so, the user is prompted for the new mark section's name. The Current and Reference sections are set to the new name, all change markers and change notes are removed, and derived output may be saved. The dialog has a **Save Derived Data** check box. This allows the user to save derived data along with the marks section. If calculations for derived parameters have not completed, the check box will be disabled. The name used for the derived data will be the same as the marks section name.

Opening a Marks Section

Any saved marks section may be opened by selecting **Open Marks Section** from the **Functions** menu. On opening a marks section, the Current and Reference sections are set to the selected section and the derived output is updated.

Opening a Reference Section

Any saved marks section may be opened as a reference section by selecting **Open Reference Section** from the **Functions** menu. On opening a reference section, the Reference section is set to the selected section and the change indicators are updated.

Saving Derived Data

Derived data can be done by selecting **Saved Derived Data** from the **Functions** menu. When this menu selection is selected a common dialog will appear asking for a file name. By default the name used will be *ReviewFile_MarksSection_d*.

Deleting a Marks Section

Any saved marks section may be deleted from the Review file by selecting **Delete Marks Section** from the **Functions** menu. Deleting a marks section removes it from the Review file; it does not change the current information.

Modifying Protocol Information

The protocol information can be modified by selecting **P3 Setup** from the **Setup** menu. From the setup dialog the following changes can be made.

Channel Input Setup - Derived Parameters, SD, and Precision.

Groups and Events - Trigger channels.

Data Reduction Setup - Fully configurable.

Graph Setup - Only Review capable analysis modules will be listed. Primary, Trend, and XY-Loop graphs are supported. Advanced traces are not supported.

Settings - Data Separator, Time Formats, Group mode in data parser are supported.

Logging rate is modified by using the F8 key or selecting **Logging Rate** from the **Functions** menu.

Saving Protocol Information

The protocol information in the current review file may be saved by selecting **Save Review Protocol** from the **Functions** menu. Alternatively a new Review file may be created by selecting **Save Review Protocol As** from the **Functions** menu. If changes have been made to a review's protocol information that may affect marks sections that were saved earlier, the user will be warned that using **Save Review Protocol As** may be more appropriate.

Using Security with Review

Review works with the Data Security Option (DSO) to secure data and to provide traceability. When changes are made to marks locations with DSO enabled, users must provide a reason for the changes prior to saving a marks section. The same holds true when changing attributes and saving the protocol information.

When used with DSO, derived output generated by review is signed only if the associated .RAW file is signed. Protocol information and marks sections are always signed.

Access Levels

The following items can be controlled through Access Levels.

Review - Open File

The **Open Review File** menu selection will be disabled if this feature is restricted. If an Access Card is swapped for another Access Card that is not granted access, after the menu item is accessed, an error message will be posted.

Review - Open Marks Information

If access to this feature is restricted, the menu selection for **Open Marks Section** and the **OK** button on the **Open Marks Section** dialog will be disabled.

Review - Save Marks Information

If access to this feature is restricted, the menu selection for **Save Marks Section** and the **OK** button on the **Save Marks Section** dialog will be disabled.

Review - Open Ref Information

If access to this feature is restricted, the menu selection for **Open Reference Section** and the **OK** button on the **Open Reference Section** dialog will be disabled.

Review - Move Marks

If access to this feature is restricted, the mouse cursor will not change to a left/right arrow when over a validation mark, and the user will not be able to move any validation marks. Further, the **Undo Move** selection will not be available in the right click menu.

Review - Delete Marks

If access to this feature is restricted, **Delete Mark** will not be presented as an option when right clicking on a validation mark.

Review - Add Marks

If access to this feature is restricted, **Insert Mark** will not be presented as an option through the right click menu.

Review - Add Notes

If access to this feature is restricted, **Add Freeform Note** and **Add Change Note** will not be presented as options when a right click is performed on a change marker. The **OK** button in the **Add Notes** dialog will be disabled as well.

Review - Display Options

If access to this feature is restricted, **Display Options** will not be presented as an option through the right click menu. The **OK** button in the **Display Options** will be disabled as well.

Review - Change X Axis

If access to this feature is restricted, the expand and compress tool bar buttons will be disabled. Further, the X axis scaling related parameters will be disabled in the **Axis Change** dialog.

Review - Change Y Axis

If access to this feature is restricted, the Y axis scaling related parameters will be disabled in the **Axis Change** dialog.

Review - Delete Marks Information

If access to this feature is restricted, the user will not be permitted to delete or overwrite marks sections.

Review - Add Bad Data Sections

If access to this feature is restricted, the user will not be permitted to add bad data sections.

Review - Move Bad Data Sections

If access to this feature is restricted, the user will not be permitted to move bad data sections.

Review - Add Events

If access to this feature is restricted, the user will not be permitted to add events.

Review - Delete Events

If access to this feature is restricted, the user will not be permitted to delete events.

Review - Move Events

If access to this feature is restricted, the user will not be permitted to move events.

Review - Print

If access to this feature is restricted, the user will not be permitted to print from Review.

Review - Delete Notes

If access to this feature or **Review - Add Notes** is restricted, the user will not be permitted to delete notes.

Review - Stop

If access to this feature is restricted, the user will not be permitted to end a review session.

Review - Delete Bad Data Sections

If access to this feature is restricted, the user will not be permitted to delete bad data sections.

Review - Print Setup

If access to this feature is restricted, the **OK** button on the **Review Print Setup** dialog will be disabled.

Review – Data Parser Setup

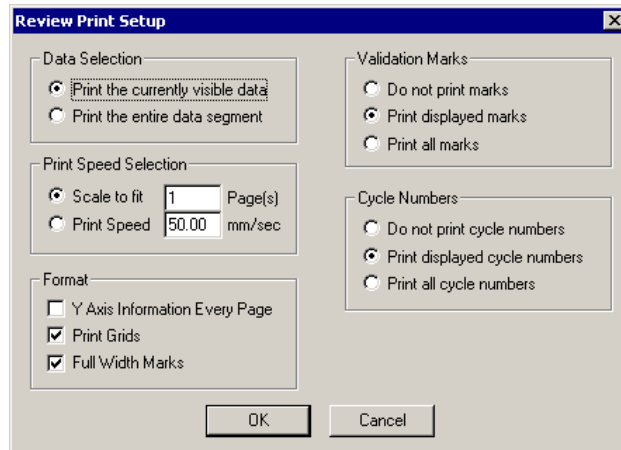
If access to this feature is restricted, the user will not be permitted to setup Data Parser.

Review - Save Parsed Review File

If access to this feature is restricted, the user will not be permitted to save a parsed review file.

Printing

Data can be printed on any external printer that has been previously set up. From the main P3 Plus menu, select **Review Print Setup** from the **Setup** menu to obtain the **Review Print Setup** dialog.



Review Print Setup dialog

Data Selection

This group is used to select the data that will be printed. It permits the selection of either the data as seen in the Review window or the entire data segment.

The default is **Print the currently visible data**.

Print Speed Selection

This group is used to adjust the X-axis scale on the printout. The selected data may either be printed on a specified number of pages by regulating the print speed or by setting the print speed and letting the printout span the necessary amount of pages required to print the data.

The defaults for this group are **50 mm/sec** for **Print Speed** and **1 Page(s)** for **Scale to fit**.

Format

This group contains the formatting options for printing Review data.

Y axis scaling information and labels are always printed on the first page. If **Y Axis Information Every Page** is selected, the Y axis information will be displayed on each page of a multiple page printout. The default is disabled.

When **Print Grids** is enabled, grids are printed on the printout. The default is enabled.

When **Full Width Marks** is enabled, validation marks are represented as vertical lines spanning across the channel area. When the **Full Width Marks** check box is disabled, the validation marks are represented as short lines at the bottom of the channel area. The default is enabled.

Validation Marks

This group controls the three options for printing validation marks. Printing validation marks may be suppressed by enabling **Do not print marks**, validation marks may be printed, as seen in the Review window, by enabling **Print displayed marks** or all validation marks may be printed by enabling **Print all marks**. Validation marks may be controlled on a channel-by-channel basis by right clicking in the Review window on a channel. The default is **Print displayed marks**.

Cycle Numbers

This group controls the options for printing cycle numbers. Printing cycle numbers may be suppressed by enabling **Do not print cycle numbers**, cycle numbers may be printed, as seen in the Review window, by enabling **Print displayed cycle numbers**, or all cycle numbers may be printed by enabling **Print all cycle numbers**.

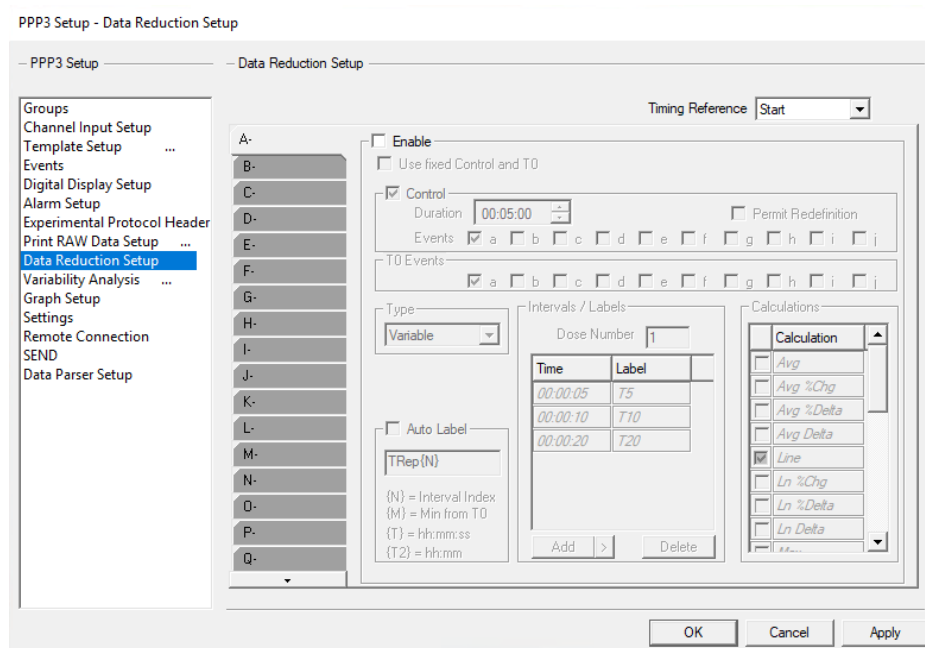
The default is **Print displayed cycle numbers**. Cycle numbers may be controlled on a channel-by-channel basis by right clicking in the Review window on a channel.

Data Reduction

Data reduction has the capability of reducing data dependent on parser segments or data segments. The selection of **Parser Seg** is available and is typically used when in Parser View Mode, or Review.

Selecting **Parser Seg** will reduce each parsed section of data, using the first parser section as the control if the control is enabled. In the example below, Avg (Average) is selected for the calculation. For each Parser segment, data within each segment

will be averaged and this information placed into the Data Reduction spreadsheet for each parameter enabled from the derived parameters list (Channel Input Setup).



Parser segments may be initiated by a specific time (see **Data Parser** section) or configured to be triggered by an event from Data Reduction. This can be accomplished by selecting the T0 event to initiate a start point for segments in the Data Parser dialog.

Labels may be configured automatically by using the **Auto Label** feature or configured manually.


- Auto Label {N} provides an automatic index from T0. The first data reduction interval based on T0 will be 0. Using the default text of TRep, intervals will be TRep0, TRep1, TRep2 and so forth.
- Auto Label {M} provides the time from T0 in minutes. For example, if Data Reduction intervals are set to 30 minutes (time), each interval from T0 will be labeled at 30 minute increments (TRep0, TRep30, TRep60, etc.).
- Data Parser labels may be linked to Data Reduction. To link Data Parser labels, select “Group Mode in data parser” in the Settings dialog (PPP3 Setup menu). This will allow the user to utilize the labels set up in Data Reduction whenever Apply Rules is selected in the Data Parser dialog. Note that the user may also edit parser segment names in the Individual Segments tab in the Data Parser dialog by clicking in the Label field. However, clicking on Apply Rules in the Parser Rule Setup tab will remove any previously defined names from the Individual Segments tab. If Data Parser segments are not linked to Data Reduction, the software will default to index for the labels.
- If Data Parser segments are linked to Data Reduction, there is a 15 character limit for interval text except for the Control segment which is limited to nine characters.

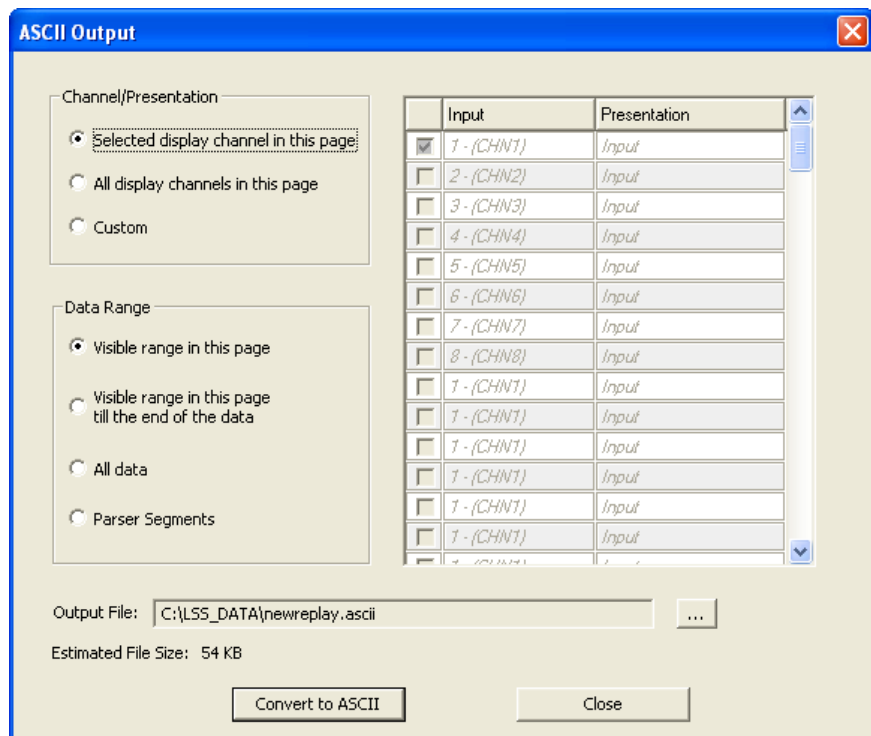
Refer to the **Data Parser** section for configuration details regarding parser setup.

Note: If no event exists in the data (no T0 event), no data will be present in the Data Reduction table(s).

Note: In Review, if Data Reduction is set to Parser Segments and Control is enabled, the segment that begins before or on the latest Control event will be used as the Control interval. Any segment existing prior to the determined Control interval will be ignored by Data Reduction.

ASCII Output

Review has the capability of converting the graphically displayed information into an ASCII file. Each graph page has a button, , (hovering over the buttons will show tool tips) that allows access to the **ASCII Output** dialog. The dialog can also be accessed from the graph **File** menu and P3 Plus **Functions** menu. Shown below is an example of the **ASCII Output** dialog.



Channel/Presentation

The **Channel/Presentation** allows the user to select which channels and presentations will be converted. The **Selected display channel in this page** will only convert the highlighted channel from the graph page. The **All display channels in this page** will convert every channel that is listed in the graph page. The **Custom**

option will enable the grid on the right of the dialog. This will allow the user to configure any channel and/or presentation even if it is not configured on a graph.

Data Range

The **Data Range** allows the selection of the specific section of data that will be converted. The **Visible range in this page** will only convert the data that is visible in the page. The **Visible range in this page till the end of the data** will convert the data from the beginning of the graph page all the way to the end of the data. The **All data** option will convert all of the data. The **Parser Segments** will convert all of the data within all of the data parser segments that are configured.

Output File

The **Output File** allows the user to specify the location where the file will be generated. The button to the right can be used to change the name and directory of the output file.

Listed below the **Output File** is an estimation of the file size of the ASCII file that will be generated based on the options currently selected.

The **Convert to ASCII** button will convert the data based on the settings selected. The dialog will not close once a conversion is done. This allows the user to run multiple conversions without having to reopen the dialog. Clicking on the **Close** button will close the dialog.

Operation of ASCII Output

The **ASCII Output** dialog will change based on the location from where it is opened. If the dialog is opened from a graph page, all available options will be enabled. If the dialog is opened from the main P3 Plus window, the only available selection within the **Channel/Presentation** section will be **Custom**. Also, only **All data** and **Parser Segments** will be available within the **Data Range** section. The **Parser Segments** option will only be available if data parser segments exist in the Review file.

If a graph exists that has both primary and secondary channels configured and both channels are outputted, the secondary channel will have duplicate data listed based on the primary channels sample rate setting. Ex. If the primary sample rate is configured as 1000 and the secondary sample rate is configured as 250, when a convert is done with both channels, the data for the secondary channels will be duplicated 4 times.

If only a secondary channel is configured, duplicate data will not be listed.

Bad Data Mark Percentage

Bad Data Mark Percentage provides the ability to view the percentage and distribution of data removed by Bad Data Marks. This allows the user to determine if too much data has been excluded from analysis. Additionally, this feature allows the user to report on the number of “Good” cycles.

To enable this feature, access the Application Configuration dialog from the Options pull-down menu. From the Advanced selection, scroll through the list of features and change the value from 0 to 1 for the `BadDataMarks.Percentage` option.

Configuration - Advanced

Configuration - Advanced

Configuration | Advanced

Acquisition Interface
Data Paths
Miscellaneous
Review
Animal ID
Graph Defaults
Attribute Defaults
Email Alerts
Advanced

Setting	Value
AnimalID.Enable	0
AnimalID.Handshake	0
AnimalID.Mode	0
AnimalID.Port Type	0
AnimalID.Unit Type	0
BadDataMarks.Percentage	1
BinSet.DBVer	1
DefaultBarometricPressure	760
DefaultSpecies	Dog
Directories.CalValueDatabase	C:\Ponemah_v5_5
Directories.DerivedPath	C:\Ponemah_Data\

OK Cancel

Available channels are listed along with a **Channel/Time Segments** column defaulting to 1 minute segments. The channels display the percentage of Total Bad Data for the study (first line in the spreadsheet) as well as percentages for each segment. A graphical representation of the bad data distribution is provided in the bottom half of the window.

Bad Data Distribution

Channel/TimeSegments	Ch1:CHN1	Ch2:CHN2
Total Bad Data	4.00%	3.44%
TimeSeg 1 (0000:09:54.660)	0.00%	0.00%
TimeSeg 2 (0000:10:54.660)	0.00%	0.00%
TimeSeg 3 (0000:11:54.660)	0.00%	0.00%
TimeSeg 4 (0000:12:54.660)	0.00%	0.00%
TimeSeg 5 (0000:13:54.660)	0.00%	0.00%
TimeSeg 6 (0000:14:54.660)	8.20%	0.00%
TimeSeg 7 (0000:15:54.660)	100.00%	20.37%
TimeSeg 8 (0000:16:54.660)	100.00%	7.00%
TimeSeg 9 (0000:17:54.660)	100.00%	0.00%
TimeSeg 10 (0000:18:54.660)	100.00%	0.00%
TimeSeg 11 (0000:19:54.660)	100.00%	0.00%
TimeSeg 12 (0000:20:54.660)	83.60%	0.00%
TimeSeg 13 (0000:21:54.660)	0.00%	0.00%
TimeSeg 14 (0000:22:54.660)	0.00%	0.00%
TimeSeg 15 (0000:23:54.660)	0.00%	0.00%
TimeSeg 16 (0000:24:54.660)	0.00%	0.00%
TimeSeg 17 (0000:25:54.660)	0.00%	0.00%

Report: Time Segment: mins

Graph Channel:

Bad Data Percentage

Total Time: 0011:50:09.838

Report

This field allows the user to select **Bad data percentage** or **Number of Good Cycles in a Segment**. Choosing of one of these selections will automatically update the data columns with the appropriate information.

Time Segment

Time Segment determines how the data is averaged and displayed. The default value is 1 and the units are in minutes. The maximum value that can be entered is 9999.

Refresh

After changing the value in the **Time Segment** field, the **Refresh** button must be selected in order to update the data.

Copy to Clipboard

This feature allows the calculated data to be copied and placed into another format such as Microsoft Excel or Word.

OK

This button closes the window.

Graph Channel

This feature allows the user to switch between inputs. Only one channel may be displayed at a time.

Template Analysis

View the Template Analysis Manual (MU00279) for details on how template analysis operates.

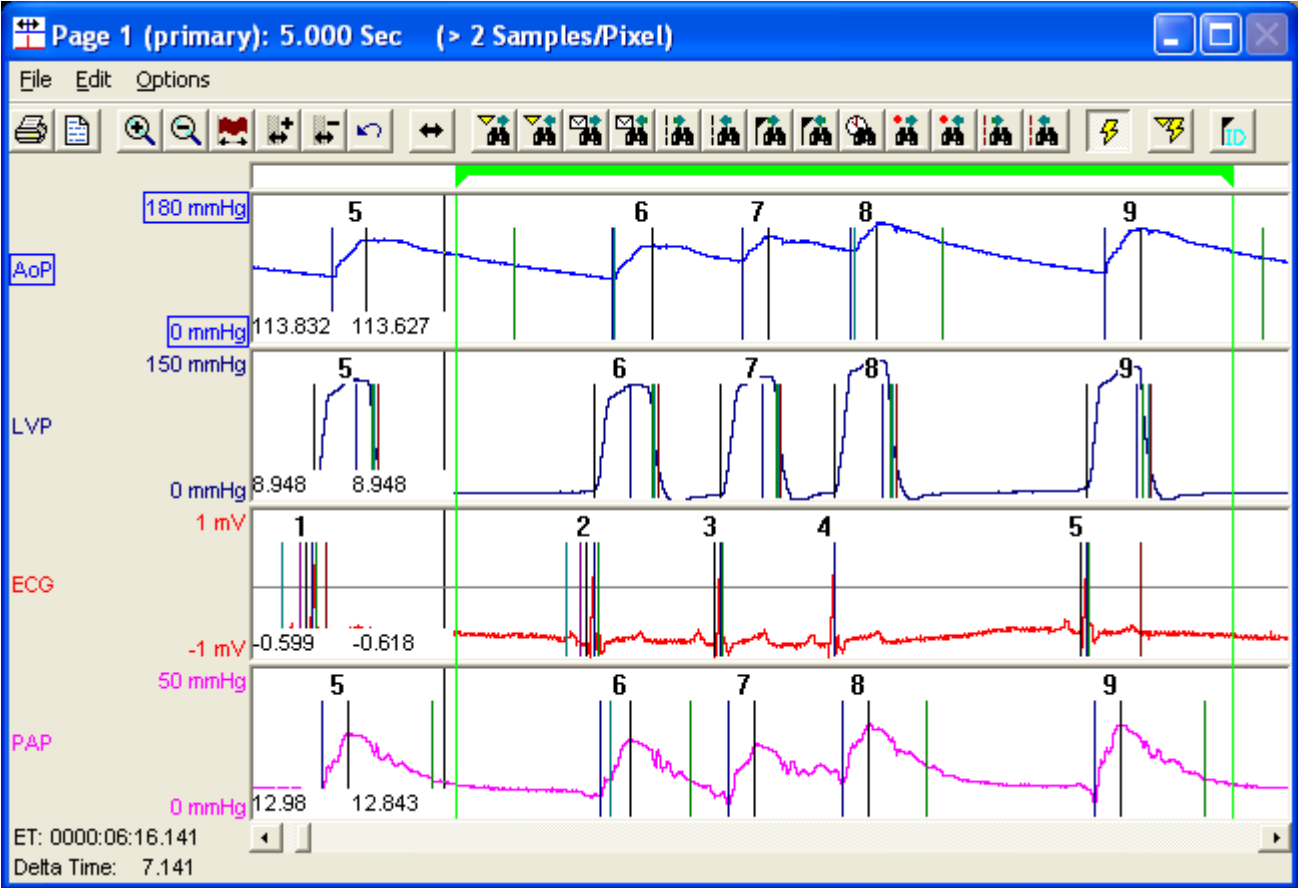
P3 Video

View the P3 Video Manual (MU00278) for details on how Video operates.

Data Parser

Introduction

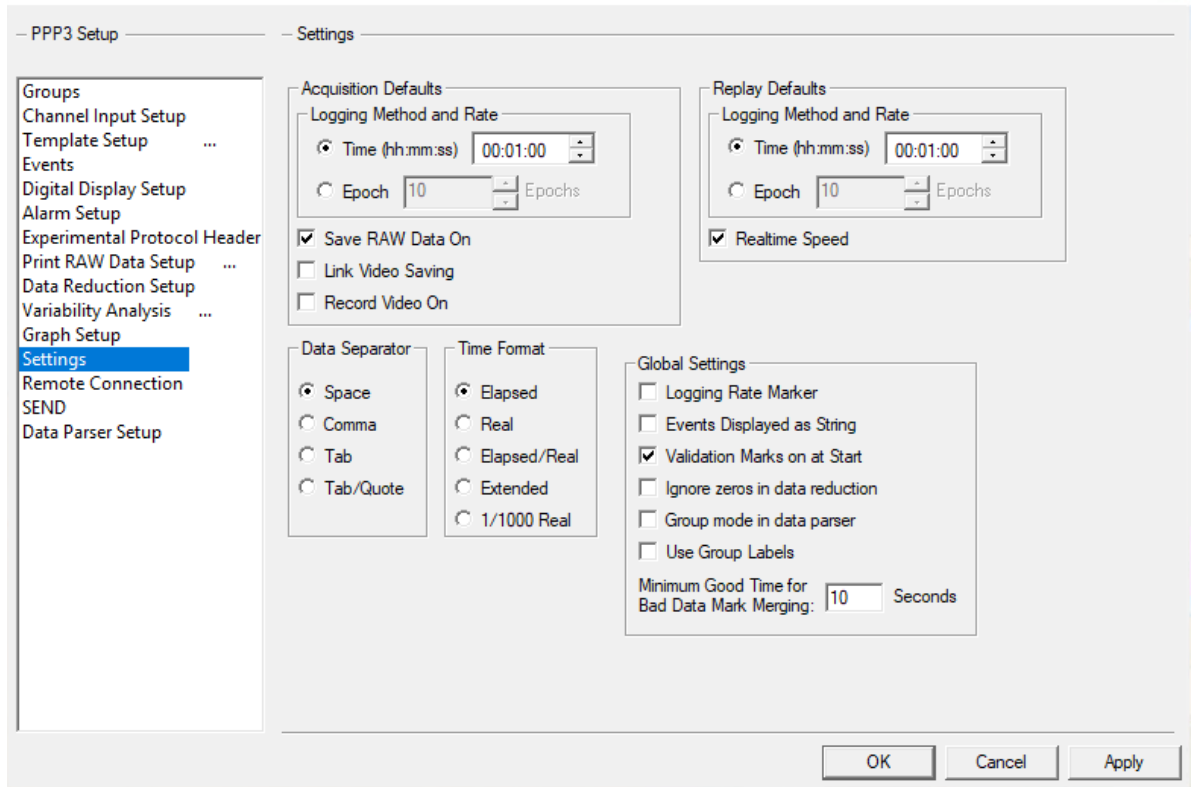
The Data Parser is a tool designed to permit the selection of a portion of a Review file with a view to creating a smaller Review file, viewing only the selected data or saving derived data corresponding to the selected data. Data Parser functionality is only available from within a Review session. However the data parser setup may be initialized outside of Review.



Data Parser Setup

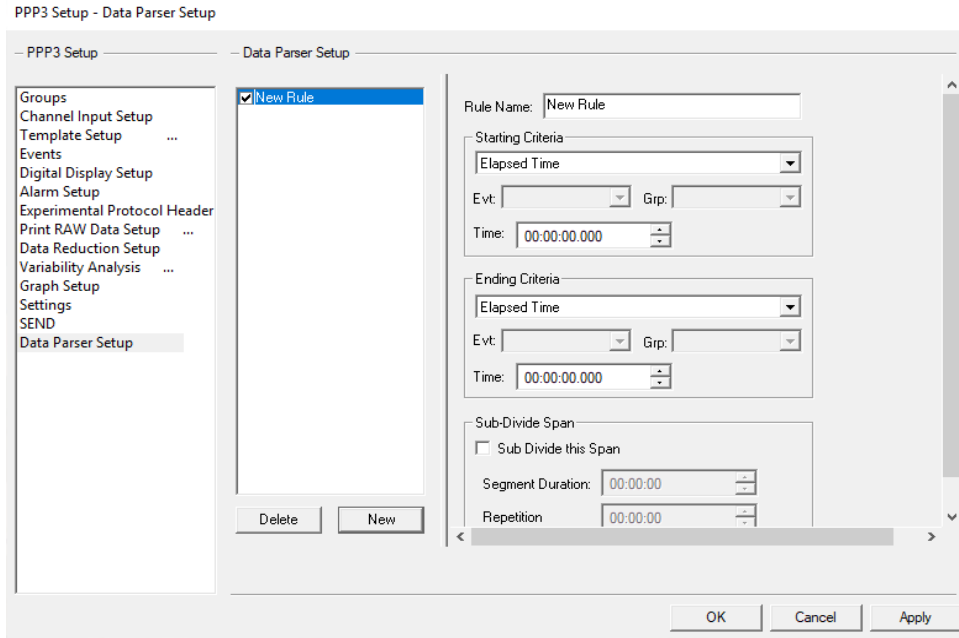
The data parser setup is composed of two parts, defining the time intervals to be parsed (the parser segments) and defining the channels or groups to be parsed. By default no parser segments are created and all channels or groups available in the RAW file are selected for parsing. Group parser is initialized through *P3 Setup: Settings: Global Settings; Group Mode in Data Parser*.

PPP3 Setup - Settings

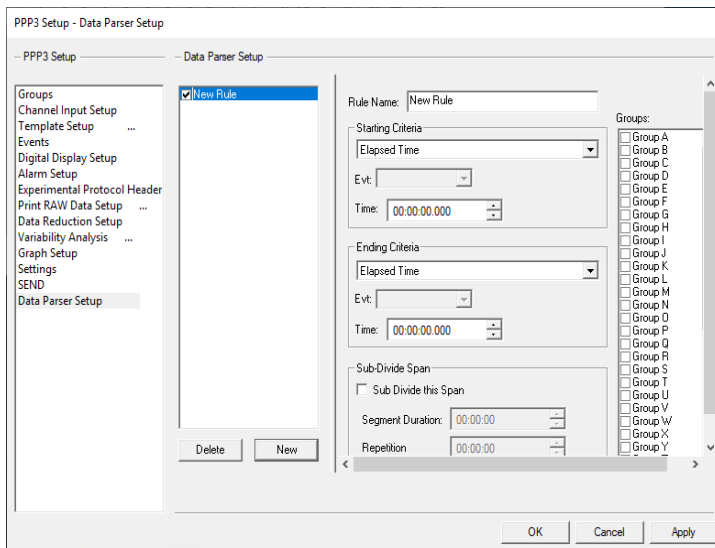


PPP3 Setup Dialog –Settings- Global Settings – Group Mode in Data Parser

The channels may be further defined when a review file is opened by excluding channels from review. Below are examples of the Data Parser Setup configuration from the PPP3 Setup dialog (in idle mode).



PPP3 Setup Dialog - Data Parser Setup Configuration



Group Mode - PPP3 Setup Dialog - Data Parser Setup Configuration

Data Parser Segments

Parser segments may be defined graphically, they may be defined by typing in start and end times for each segment or they may be defined by setting up rules for the creation of parser segments. The Graphical setup is a more direct approach to setting up parser segments, however, not all aspects available through rules are available. In either case the segments are represented in the parser bar, which is located at the top of the time based graph pages to the right of the parser segment definition icon. The

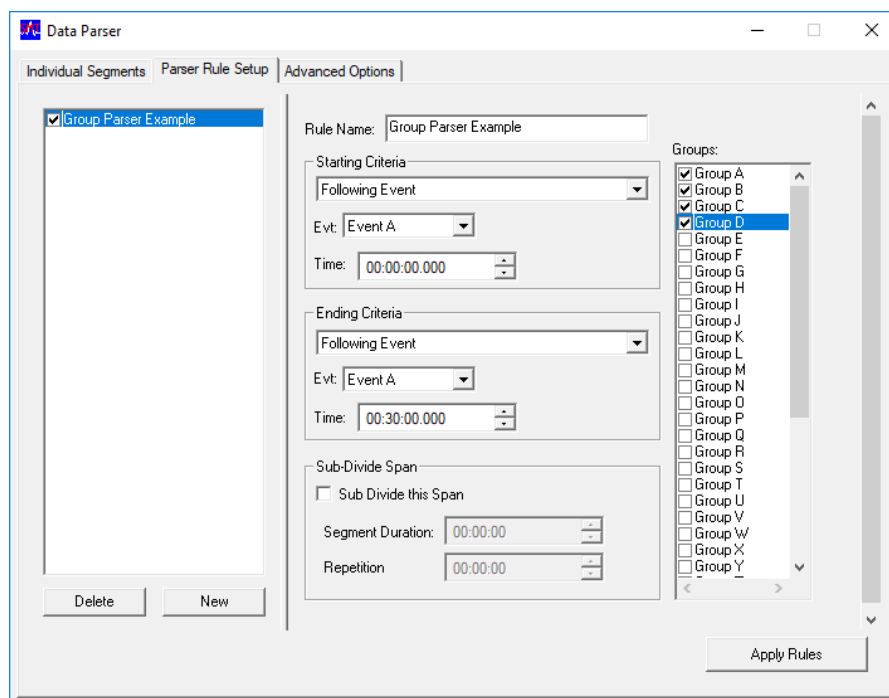
parser bar may be displayed/hidden by selecting *Display Parser Bar in Graphs* from the *Data Parser* menu, while in Review. The default selection is visible.

Parsed segments preserve the relationship between channels for the start sample. Thus the first and last points selected will be an even multiple of the lowest channels sample rate, offset from the first sample on the master sample rate channel. The modified samples will lie within the currently selected range.

Rules

Rules are used to create parser segments, and may be specified in terms of time or events. During Review rules must be *applied* to create the parser segments that correspond to the rules. If rules are available when the Review file is created, the rules will be applied automatically. While in Review the user must manually apply rules to update the parser segments. The rules are saved in the protocol file and may be defined in idle mode or during review. In idle mode, the rule setup page is accessed through *P3 Setup: Data Parser Setup*. During Review, the rule setup page is accessed through the *Parser Rule Setup* tab in the Data Parser Setup dialog *Data Parser: Open Parser Dialog*.

Currently defined rules are displayed in the list to the left. New Rules are added using the *New* button and existing rules may be deleted using the *Delete* button.



Rule Name: Used to identify the rule.

Groups (group parser mode only): Defines the groups to be parsed.

Starting Criteria: Defines the start point for the rule based on elapsed time or an event (prior to or following) if an event is used. The group that the event is associated with must be specified as when not using group parser mode.

Ending Criteria: Defines the end point for the rule based on elapsed time, an event (prior to or following), or a time span. If an event is used, the group that the event is associated with must be specified as well.

Sub Divide Span: If *Sub Divide this span* is checked, multiple segments will be created over the duration specified in the rule. The segments will repeat at the specified *Repetition Interval* and will be of a length specified by *Segment Duration*.

Apply Rules: This button is available when in Review and will convert the rules to parser segments. The times associated with the parser segments may be viewed in the *Individual Segments* tab and a graphical representation of the parser segments may be viewed in the parser bar in time based graph pages. If multiple rules are present when *Apply Rules* is selected, overlapping parser segments may be created. If this happens the segments from multiple rules are OR'ed together and these parser segments will appear as combined segments.

When using the same event letter to specify start and end criteria, two separate events must be entered. Data parser will not use a single event to trigger both start and end. If a fixed time is desired from the start, Time Span should be used.

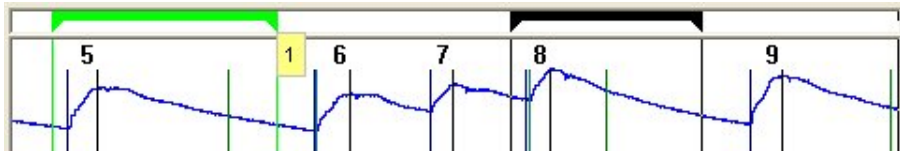
Once segments have been created, they are no longer directly associated with the underlying rules. Thus in the case of rules based on Events, any subsequent changes to events will not affect the parser segments unless the underlying rules are reapplied. The rules and the parser segments may be modified independently. The parser segments may be modified graphically on time based graph pages.

If a rule is configured that uses a secondary sample rate, the result may appear different than expected. If the rule starts at a time that is in between secondary sample rate samples, the rule will start at the next time point that a secondary sample rate sample exists. Ex. Sample rates are configured as 1000 and 50, an event is set at time 1.568, and a parser segment is configured 0 seconds before the event for 10 seconds. Since the event is at 1.568 and the secondary sample rate is set to 50, the parser segment will start at the next secondary sample rate sample, which is 1.580. The end of the segment will be at time 11.560.

Graphical Segment Definition

Parser Segments may be created or modified through time based graph pages when the *parser bar* is displayed. The Parser Bar may be displayed in review while not in Parser View mode. New segments may be created by right clicking in the Parser Bar and selecting *New Parser Segment*. Existing parser segments may be deleted by right clicking on it and selecting *Delete Parser Segment*. A parser segment may be moved without changing its duration, by left clicking and dragging the segment within the parser bar. The start and/or end times of a parser segment may be modified by left clicking on the edge of a parser segment within the parser bar and moving it to the desired location. Movement of parser segments is restricted to prevent overlapping adjacent segments and to stay within the available data.

When a data parser segment has been selected in the parser bar of the graph, that segment will change to green, as shown below.



If the user hovers over the parser segment in the parser bar, a tool tip will appear to show which parser segment is selected. Also, both the DRx and Data Reduction list views will highlight the corresponding derived data. If you hover over the highlighted sections in either the DRx or Data Reduction list views, the parser segment ID will appear as shown below.

Label	Start Time	End Time	Duration	1: Num	1: Sys	1: Dia	1: Mean	1: PH
TRep0	0000:07:00 ...	0000:07:30 ...	0000:00:30 ...					
Avg				69.00	147.55	100.40	121.57	47.152
Max				69.00	164.34	126.95	135.34	59.631
Min				45.00	135.25	88.934	114.78	32.992
SDev Est				7.3598	8.0626	12.328	6.1799	7.9765
TRep1	0000:07:30 ...	0000:08:00 ...	0000:00:30 ...					
Avg				95.00	144.34	98.688	119.37	45.653
Max				95.00	171.11	128.38	138.99	59.323
Min				70.00	127.56	79.303	103.68	34.733
SDev Est				7.6485	12.285	15.165	9.524	7.5976

Time Based Segment Definition

The start and end times for each parser segment may also be viewed in the *Individual Segments* tab in the Data Parser Setup dialog regardless of whether the segments were created by rules or graphically. Parser segments applied to multiple groups may also be viewed here. The start and end times for each group will be applied to its respective group. Any graphical changes to segment times will be reflected. Segments may be added or deleted and their start and end times may be modified in the *Individual Segments* tab. If an invalid entry is made when typing in a time, the closest valid time will be entered in the list to the left. Inserting a segment using the insert button will insert a segment centered in the interval prior to the currently selected segment and will be of a length of half the interval. When entering information in the Individual Segments Tab, start/end times may be entered that do not start on a sample. When modifying individual segments, the permitted modification range extends to the end of the previous segment and the beginning of the next segment.

Label	Start	End	Duration	Breaks	Data %
1	00:06:09.000	00:06:39.000	00:00:30.000	0	100%
2	00:07:09.000	00:07:39.000	00:00:30.000	0	100%
3	00:08:09.000	00:08:39.000	00:00:30.000	0	100%
4	00:09:09.000	00:09:39.000	00:00:30.000	0	100%
5	00:10:09.000	00:10:39.000	00:00:30.000	0	100%
6	00:11:09.000	00:11:39.000	00:00:30.000	0	100%
7	00:12:09.000	00:12:39.000	00:00:30.000	0	100%
8	00:13:09.000	00:13:39.000	00:00:30.000	0	100%
9	00:14:09.000	00:14:32.932	00:00:23.932	0	100%

Group Mode Parser View for Individual Segments

The following information is available in the Segment Information Group box:

Label: Defines a label for each Data Reduction interval (for more information, see the Ponemah Physiology Manual MU00060).

Start: The start time of the segment in elapsed time.

End: The end time of the segment in elapsed time.

Duration: The total time for which data are available in the segment. If no data breaks are present, this will equal Time Span else it will be less than Time Span.

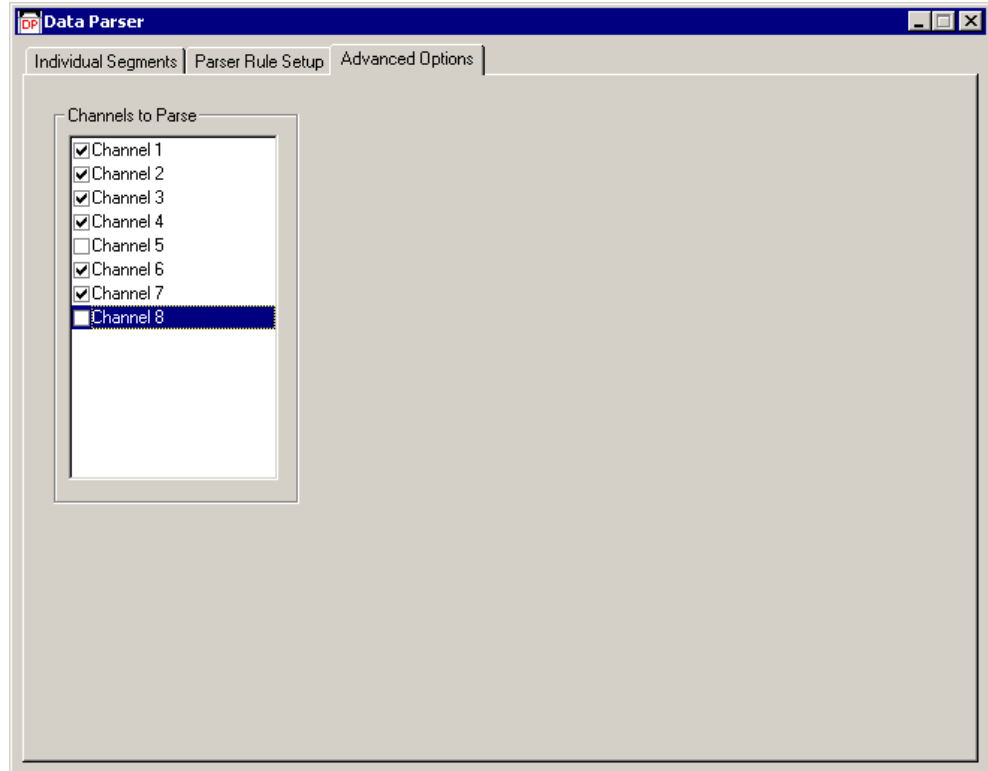
Breaks: The number of data breaks covered by the segment. A data break is when the saving of raw data has been turned off during acquisition. There will be a green dashed line where the break in the data occurs. Data breaks can also occur when a parsed review file is opened.

Data %: Represents the percentage of data in a segment and is calculated as the total time divided by the segment time. If not data breaks exist, this will display 100%. If data breaks do occur, it will calculate the percent of data present. For example, if the total time of the segment is one hour but only 45 minutes are collected due to a data break, then the Data % will be 75%.

If Individual Segments exist and the user clicks on the Apply Rules button, of the Parser Rule Setup tab, the original individual segments will be removed.

Specifying Channels to be parsed

The user can choose which channels will be parsed in the *Advanced Options* tab in the Data Parser Setup dialog. If a parsed Review file is created or if parsed derived data is saved, only data from channels selected will be parsed.



Viewing Parsed Data (Parser View Mode)

Once parser data segments are defined, entering *Parser View Mode* (Menu: *Data Parser: Parser View Mode*) will do the following: The graph pages will be modified to display only time intervals corresponding to the parser segments. Only marks for cycles that fall entirely within the parser segments will be used in calculations.

Marks for partial cycles will be displayed however they will not be assigned cycle numbers and will not be used in calculations. The derived parameter list views and the data reduction list views will be updated to reflect the new data ranges. The events list view will only list events that fall within the parser segments. Printing review data while in Parser View mode will only print parsed data segments. Note: When using group parser mode, the graph pages, the derived parameter list, and the data reduction list will include the breadth of all parsed data regardless of the specific time points associated with each group.

Any changes made to marks while in Parser view mode will persist when switching out of Parser View Mode. If a channel is reanalyzed while in Parser view mode, only the marks that lie within the parser segments will be affected. However, changes to Signal Conditioning Attributes and Calculation Attributes will be applied to the entire data set e.g. filter changes and calculated parameter changes.

When in Parser View Mode, the Parser Setup Dialog will not be available. If modifications need to be made to the parser setup, it is necessary to switch back to regular review mode. While in Parser View Mode there are a number of actions that cannot be taken till the user switches out of Parser View Mode. These are: Open Review File, Open Marks Section, Save Marks Section, Save Derived Data, Delete Marks Section, Open Reference Section, Exit Review, P3 Setup, and Open Data Parser Dialog.

If channels that are not selected for parsing are present in a graph page, the channel will be graphed however no marks will be displayed for the channel and the right click menu will not be available for the channel.

Note:	If using Parser Segments or Variable Intervals for defining Data Reduction values in Review, X's will be placed in the data file for all defined segments that contain data breaks. One exception would be when defining a Control period for Data Reduction. If the Control period spans breaks in the data, values for the Control will be reported using only the last section of data from the final break in the data until the end of the control period.
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Saving a Parsed Review File

Once parser data segments are defined, a new Review and a new Raw file may be created that is comprised of the parsed data segments. The new Review and new Raw file are created by selecting the *Save Parsed Review File* menu item from the *Data Parser* menu. The user will be prompted to provide a single name for the new RVW/RAW files. The RVW file will contain marks information contained in the current marks section for the parsed segments and the new RAW file will contain the channels parsed from the original RAW data file. The protocol information in the new RVW file will be identical to the current RVW file with the exception of parser segments, which will be cleared, and with the exception of any channels that were not parsed.

Note: When using group parser mode, the graph pages, the derived parameter list, and the data reduction list will include the breadth of all parsed data regardless of the specific time points associated with each group. If parser segments are based off of events, ensure that the events are parsed with the data. If Parser rules are applied to the newly created file, the segments will only appear if the events are present. Consideration must also be taken for files containing data breaks. See NOTE above.

Saving a Parsed Review file will not be permitted in a demo system. The current marks section must be saved prior to saving a Parsed Review file. Parser segments must be available in order to save a Parsed Review file.

Security

Permission to save a parsed review file is provided through the *Review - Save Parsed Review File* feature. Overwrite protection for the RVW file is provided by the *Overwrite - Protocol Files* feature and for the RAW file is provided by the *Overwrite - Data Files* feature.

Saving Parsed Derived Data

Once parser data segments are defined, the derived calculations from the parsed segments may be saved. Parsed derived data are saved by selecting the *Save Parsed Derived Data* menu item from the *Data Parser* menu. The user is prompted for a derived file name. The default is formed as follows: *review file name_current section name_p*

Saving of Parsed derived data is not permitted in a demo system. All calculations must be complete prior to saving Parsed derived data. The current marks section must be saved prior to saving a Parsed Derived data. Parser segments must be

available in order to save Parsed derived data. When using group parser mode, the derived parameters will include the breadth of all parsed data regardless of the specific time points associated with each group.

NOTE: When using filtering, differences may arise between the derived output from Saving Parsed Derived Data and from calling Save Derived Data after saving a parsed review file. This is due to the absence of preceding data when saved segments are opened in review. The filters need some samples to initialize.

Security

Overwrite protection for the derived data is provided by the *Overwrite - Derived Files* feature.

Sample Usage

If Data Parser is used to extract information during a review session based on time/signal characteristics alone, setting up the parser segments may be performed using the parser bar located at the top of each time based graph page, when enabled. Right click in the parser bar to insert parser segments as desired. Parser segments may be adjusted by moving an entire segment without changing its span by left clicking on the middle of the bar and dragging it to the desired location. A parser segments time span may be changed by positioning the cursor over the right or left edge of the segment and left clicking when the cursor is an East-West arrow. Parser segments may also be modified through the *Individual Segments* tab in the *Data Parser Setup* dialog. More detailed control may be achieved by zooming in on a segment prior to adjusting it.

If event based selection of parser segments is desired, rules must be set up to define the segments relative to the events of interest. If event 'a' represents dosing, the following 4 rules will create segments for:

Rule 1: 10 minutes of predose data an hour prior to dosing

Starting Criteria: Prior to Event A, Group A, Time 01:00:00.000

Ending Criteria: Time Span, Time 00:10:00.00

Rule 2: 10 minutes of postdose data immediately post dose

Starting Criteria: Following Event A, Group A, Time 00:00:00.000

Ending Criteria: Time Span, Time 00:10:00.00

Rule 3: 10 minutes of postdose data every hour, starting an hour after dosing, ending 3 hours after dosing

Starting Criteria: Following Event A, Group A, Time 01:00:00.000

Ending Criteria: Following Event A, Group A, Time 03:00:00.000

Subdivide Span: Duration 00:10:00.00, Repetition Interval 01:00:00.000

Rule 4: 10 minutes of postdose data every 2 hours, starting 3 hours after dosing, and ending 24 hours after dosing

Starting Criteria: Following Event A, Group A, Time 03:00:00.000

Ending Criteria: Following Event A, Group A, Time 24:00:00.000

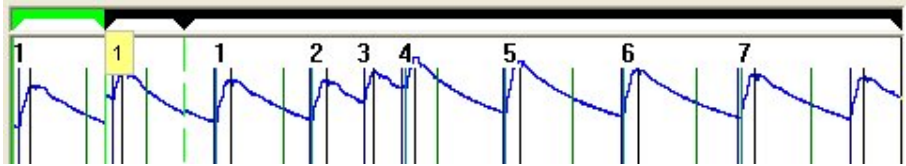
Subdivide Span: Duration 00:10:00.00, Repetition Interval 02:00:00.000

These rules may be set up in idle mode and stored in a protocol file prior to creating a review file. If rules are created during a review session that the user wishes to save to a protocol file for the creation of other review files, the Export Protocol menu item under Files in the Review Menu bar may be used.

Data Parser Graphics

While in Parser View Mode, the Parser bar is available. This bar is available to show the user the various sections of parsed data and which section is currently selected.

When a data parser segment has been selected in the parser bar of the graph, that segment will change to green, as shown below.



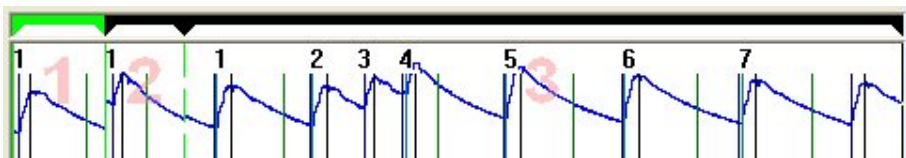
If the user hovers over the parser segment in the parser bar, a tool tip will appear to show which parser segment is selected. Also, both the DRx and Data Reduction list views will highlight the corresponding derived data. If you hover over the highlighted sections in either the DRx or Data Reduction list views, the parser segment ID will appear as shown below.

Note: The Parser bar (white space above the graph page where the parser segments may be moved or modified) can be hidden if the user deselects **Show parser bar in graphs** from the Data Parser pull down menu.

Data Reduction: A				1: Num	1: Sys	1: Dia	1: Mean	1: PH
Label	Start Time	End Time	Duration					
TRep0	0000:07:00 ...	0000:07:30 ...	0000:00:30 ...					
Avg				69.00	147.55	100.40	121.57	47.152
Max				69.00	164.34	126.95	135.34	59.631
Min				45.00	135.25	88.934	114.78	32.992
SDev Est				7.3598	8.0626	12.326	6.1799	7.9765
TRep1	0000:07:30 ...	0000:08:00 ...	0000:00:30 ...					
Avg				95.00	144.34	98.688	119.37	45.653
Max				95.00	171.11	128.38	138.99	59.323
Min				70.00	127.56	79.303	103.68	34.733
SDev Est				7.6485	12.285	15.165	9.524	7.5976

Watermarks

One graphical option available is the watermark option. The user can select the **Toggle Segment Watermarks** and view each of the data parser segments' IDs within the graph.



Data Parser Tutorial

Introduction

There are multiple ways to configure data parser sections within Review. The first two sections (Adding a Parsed Section on the Graph and Adding a Parsed Section using Individual Segments) can only be done while in Review. The section (Adding a Parsed Section using the Parser Rule Setup) can be done either in Review or through the P3 Setup dialog. Note: Group parser is initialized through *P3 Setup: Settings: Global Settings; Group Mode in Data Parser Data Parser Setup*.

Adding a Parsed Section on the Graph

Right click on the parser section of the graph (right above the first trace, there is a small white bar) and select New Parser Segment.

Altering the Size and Location of the Parser Segment

Hover over the beginning section of the parsed section. The mouse turns into a left-right arrow. Left click and drag the side to the desired location. The same holds true for the right hand section. Also, the entire segment can be moved by clicking on the parsed section while the mouse is the standard pointer (not the left-right arrow).

Repeat the above steps for multiple segments.

Adding a Parsed Section using Individual Segments

Open the Data Parser dialog by selecting **Open Data Parser Dialog** from the **Data Parser** menu.

Select the **Individual Segments** tab.

If in group parser mode, choose the appropriate group desired to parse.

Click on the Insert button.

This inserts a defaulted parser segment.

Altering the Size and Location of the Parser Segment

Adjust the Start and End times to the times needed. Select hours, minutes, seconds, or milliseconds, and either type a new number in or use the up/down arrow buttons to change the times.

Adding a Parsed Section using the Parser Rule Setup

Open the Data Parser dialog by selecting **Open Data Parser Dialog** from the **Data Parser** menu.

Select the **Parser Rule Setup** tab.

Click on the **New** button.

Enter a name into the **Rule Name** text box.

If in Group Parser Mode choose groups to be parsed.

Set the Starting Criteria. The options are:

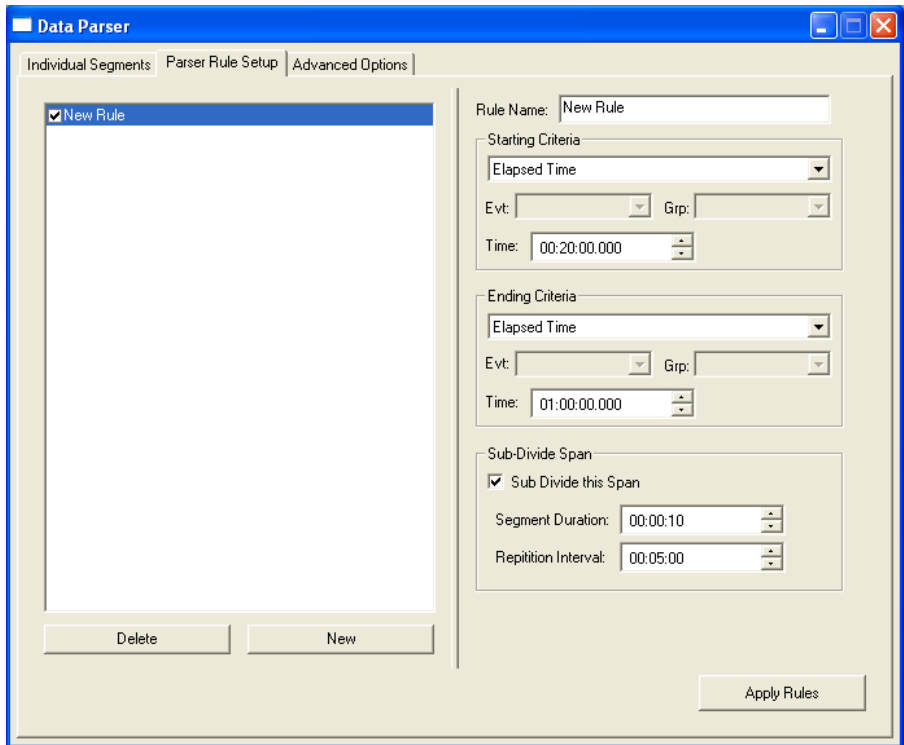
- Elapsed Time
 - Enter the starting time needed for the parser section.
- Prior to Event (existing event is needed)
 - Select the Event and Group (when not in Group Parser Mode) that the event is associated with and enter the amount of time prior to the event that will be used.
- Following Event (existing event is needed)
 - Select the Event and Group (when not in Group Parser Mode) that the event is associated with and enter the amount of time after the event that will be used as the starting point.

Set the End Criteria. The end criteria are the same as the starting criteria except for one addition:

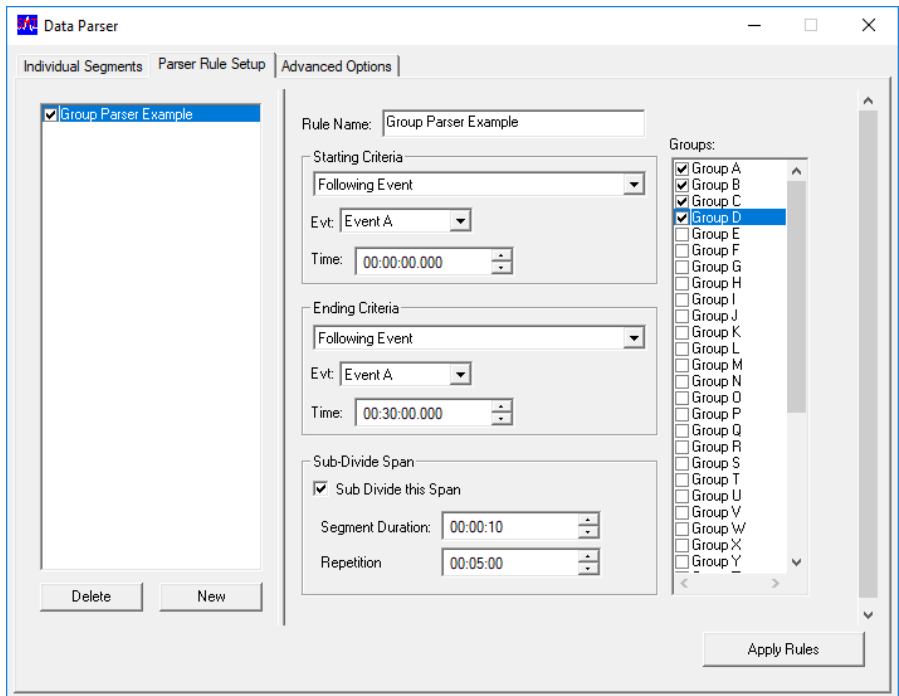
- Time Span
 - The length of time from the start point of the parsed section to the end point of the parsed section.

Set the Sub-Divide Span (Optional):

This allows the user to configure multiple parser segments. The time over which parser segments will be configured is based on the start and end criteria and each segment will be configured for the length of time set up in the Segment Duration for every Repetition Interval set. For example, if a rule is set up like the one below, 8 parser segments will be configured, each with a duration of 10 seconds.



Repeat the above steps for multiple segments or use Group Parser Mode.



Saving the Parsed Derived Data

The user can select Save Parsed Derived Data or save a parsed review file from the Data Parser menu (see the section below for saving a parsed review file).

The **Save As** dialog will appear. By default the name of the Review file and marks section is listed along with an underscore and a 'p'. The 'p' indicates the data is based off of parsed data. The user can type in any name.

Saving a Parsed Review File

The user can save a raw file based only on the parsed review sections.

Optional Steps for selecting specific channels:

- Select Open Data Parser Dialog from the Data Parser menu.
- Select the Advanced Options tab.
- Enable/Disable the channels to be parsed out (into the new raw file)

Select Save Parsed Review File from the Data Parser menu.

Enter a name into the File name text box.

A .RVW and .RAW file are created.

PV Loops

Introduction

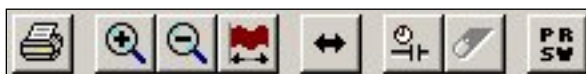
Pressure Volume Loops permit the display and analysis of left ventricular pressure cycles plotted against cardiac volume cycles. PV Loop analysis is only available within a review session that has review capable LVP and CVOL channels present.

Allocating a graph page for pressure volume analysis creates a pressure volume window. This is done by selecting PV Loops as the Type in the Graph Setup section of the PPP3 Setup dialog. A list of LVP channels is presented for the Y-axis and a list of CVOL channels is presented for the X-axis. The PV Loop selection will not be presented unless appropriate channels are available.

Layout of the PV Loop Window

The upper section of a PV Loop window consists of a graph area which is used to display XY and scatter data. The lower section of the window is split into a list view on the right that shows selected parameters for all analysis performed on the current channel pair and a status/control area on the left that provides information on the data currently in the graph area and permits the user to analyze and add data to the list view.

Toolbar



The PV Loop Toolbar consists of the following:

Print: Allows the user to print the current graph.

Expand Time Span: Allows the user to "zoom in" and show less data in the graph page.

Compress Time Span: Allows the user to "zoom out" and show more data in the graph page.

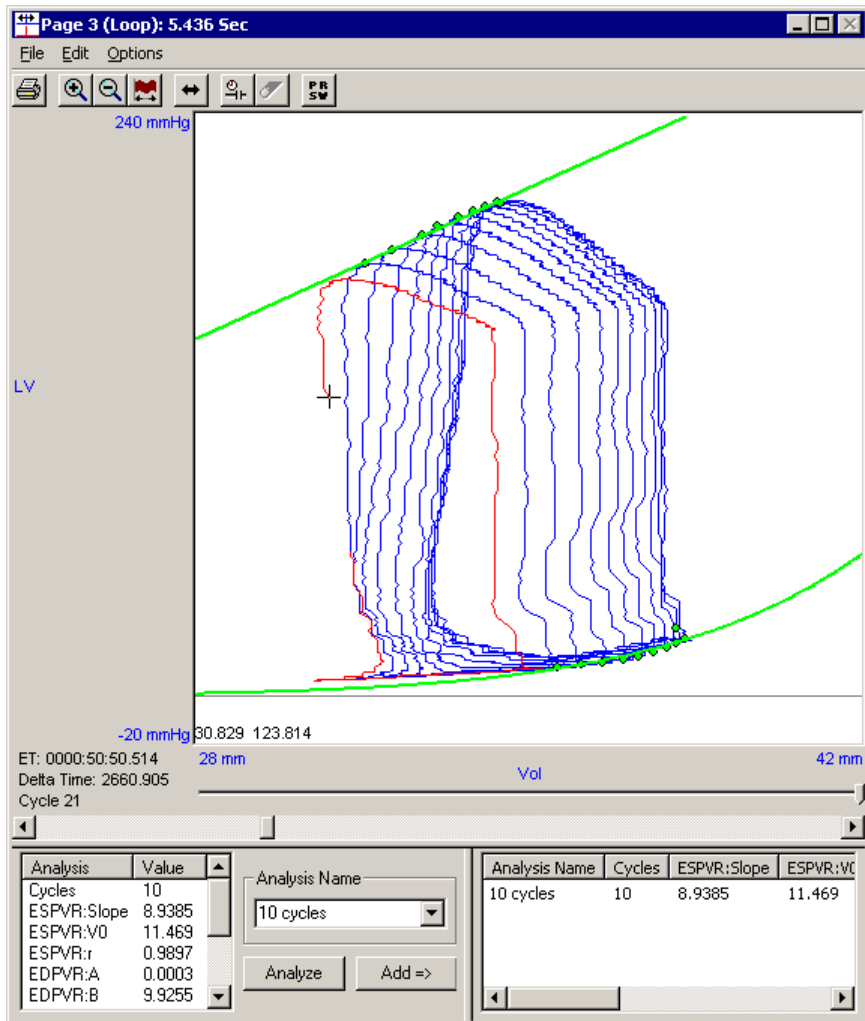
View Entire Data Set: Allows the user to view the entire data set in the graph page.

Sync with Derived Data: Synchronizes the data in the list view with the data that is currently shown in the graph page. The first line of data associated with the graph data will be scrolled into view in the derived list views.

Toggle Non-Continuous Mode: Switches between Continuous Mode and Non-Continuous Mode.

Remove all Segments from Graph: Deletes all of the data in the graph page. This option is only available when in Non-Continuous Mode.

Toggle Stroke Work View Mode: Switches between the current PV graphics and a scatter plot for Preload recruitable stroke work.



Graph Area

The graph area is used to display the selected data as an XY graph and is also used to display the results of the analysis.

The PV graph behaves very similar to an XY graph page, with the following exceptions:

Current cycle highlight:

The CVOL cycle that corresponds to the current cursor location is highlighted. If the cursor is not on a point that is part of CVOL cycle, no cycles are highlighted.

Deletion of cycles:

The CVOL cycle at the cursor location may be removed by right clicking in the graph area and selecting *Remove Cycle from Graph*.

Analysis results:

Following a successful analysis, the End Systole points and the End Diastole points are graphed and the corresponding straight line/exponential fits are drawn.

Note:	Negative LVP Values - If selected cycles for analysis include a negative LVP value, incorrect EDPVR values will result. The LVP
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	analysis module features an LVP offset attribute that conditions the signal, recalculates the derived values and redraws the LVP signal. See the P3 Analysis Module Manual (Left Ventricular Pressure section) for more detail.
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Cursor status:

Two additional status fields have been added under Delta Time. One identifies the CVOL cycle being highlighted and the other indicates whether the cursor is on an analysis point and displays either *End Systole* or *End Diastole*.

When a successful analysis is performed and cycles with valid Stroke Work values are available, a PRSW tool bar button is made available. When selected, the graph area is used to display a scatter plot for Preload recruitable stroke work as SW vs. End Diastolic Volume, along with a straight line fit to the data. When viewing the PRSW scatter plot, the scroll bar along with time scale modifications are disabled.

If, following an analysis, any changes are made to the selected data; the representation of the analysis results will be cleared.

Scroll Bar and Slider Bar

The Scroll bar at the bottom of the graph page allows the user to scroll through the entire data set with the same amount of time set up. The Scroll bar will be disabled if the graph is in non-continuous mode.

The Slider bar, located just above the scroll bar, is used to move the cursor throughout the amount of data that is currently set up in the graph page. The Elapsed Time, Delta Time, and Cycle number will change showing the user where the cursor is located.

List View

The list view displays a line for each analysis performed on the current channel pair. Parameters are selected for inclusion in the List view by right clicking on the list view header. All analysis parameters are available for selection.

Double clicking on a line in the list view will display the corresponding data segments and the associated analysis in the graph area and the status/control area. Right clicking on a line in the list view will permit deletion of the analysis for the channel pair.

Status/Control Area

This consists of an Analysis Name combo box that identifies the current analysis, an *Analyze* button that analyzes the current data, an *Add* button that adds the current analysis results to the list view, and a list view that lists the analysis results.

The Analysis Name combo box lists the analysis that has already been performed for the channel pair. Selecting one of these entries will display the associated data and analysis. In order to add a line in the list view, a unique analysis name must be provided prior to clicking on the Add button.

On selecting the *Analyze* button, the CVOL cycles that correspond to the selected data are identified and their End Systole and End Diastole points are marked. If two or more cycles are available, a straight line fit is performed and the resultant line is graphed as the ESPVR (End Systole Pressure Volume Relationship). The EDPVR

(End Diastolic Pressure Volume Relationship) is an exponential curve fitted to the following equation:

$$P = Ce^{\beta V}$$

Where P and V are the set of data point to be fitted and C and β are the unknowns.

The correlation coefficients (or the goodness of fit) r are calculated as:

$$r = 1 - \frac{\sum (y' - y)^2}{\sum (\bar{y} - y)^2}$$

Where y is the dependent variable y' is the predicted value for y and \bar{y} is mean of y.

Derived data listed in the analysis tab are filled in on selecting Analyze:

Cycles

The number of CVOL cycles that correspond to the selected data segments.

ESPVR:Slope

The slope of the straight line fit for ESPVR.

ESPVR:V0

The X intercept of the straight line fit for ESPVR.

ESPVR:r

The correlation coefficient for the straight line fit for ESPVR.

EDPVR:A

α from the EDPVR relationship.

The X intercept of the straight line fit for ESPVR.

EDPVR:B

β from the EDPVR relationship.

EDPVR:V0

V_0 from the EDPVR relationship.

EDPVR:r

The correlation coefficient for the exponential fit for EDPVR.

PRSW:Slope

The slope of the straight line fit for PRSW.

PRSW:V0

The X intercept of the straight line fit for PRSW.

PRSW:r

The correlation coefficient for the straight line fit for PRSW.

Security

The feature **PV Loops - Add Analysis** in the P3 Plus Admin application controls access to the **Add** => Analysis button.

Dragging and Dropping Data

The user has the capability of dragging and dropping selected data from the DRx and Data Reduction list views of the main review window to the graph pages. This allows the user to select specific data in the list view and view that data in the graph pages easily.

If non-continuous data is dragged and dropped into a PV Loop graph, the graph will switch to non-continuous mode. This is noted by the Non-Continuous Mode button becoming enabled and the slider bar will be shown in sections, rather than one continuous bar.

Parser View Mode for PV Loops

PV Loops are not supported in Parser View Mode and parsed derived output for PV Loops will not be generated.

Derived Output

PV Loops derived output is only sent to ODBC. A tab is created for each PV Loop window and contains the following columns: AnalysisName, Cycles, CVolChannel, LVPChannel, and all selected parameters in the list view.

Variability Analysis

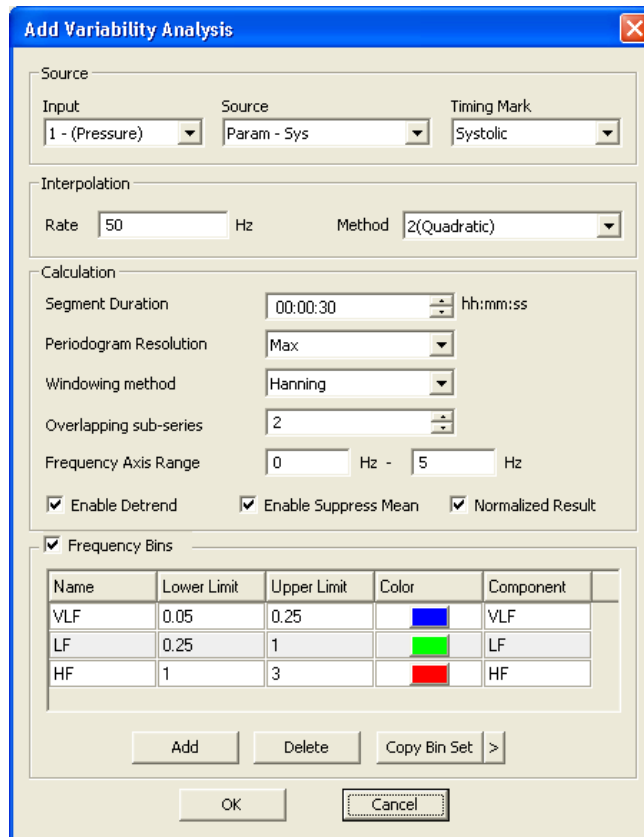
Variability Analysis Introduction

Variability Analysis permits Heart Rate Variability (HRV) analysis via ECG waveform data and blood pressure variability (BPV) via blood pressure waveform data. Variability Analysis functionality is only available from within a Review session. However, the Variability Analysis may be initialized outside of Review.

HRV and BPV are tools that represent the balance between sympathetic and parasympathetic branches of the autonomic nervous system. High HRV is an indication of healthy autonomic and cardiovascular response while low HRV indicates that sympathetic and parasympathetic nervous systems are not properly coordinating to provide an appropriate heart rate response. There are a number of factors that can affect HRV (both positively and negatively) including: reflexes, respiration, renin-angiotensin system, physical or mental stress, exercise, cardiovascular and non-cardiovascular disease states, age and drugs.

Variability Analysis Setup

In order to use Variability Analysis the user must have at least one channel set to ECG, BP or LVP for the analysis option. Variability Analysis set-up is accessible by choosing **P3 Setup** from the **Setup** menu. Select the Variability Analysis option. Click on **Add...** to create the Variability Analysis segment.



Add Variability Analysis Dialog

Source

Input

The channel input to get used for the analysis.

Source

The parameter used for the variability analysis. The RR-I is typically used for HRV and Systolic BP is typically used for BPV.

Timing Mark

Used as the time stamp for reporting parameter data. Typically, the R-wave is used for ECG and HRV, values for BPV vary depending on the parameter source being used.

Interpolation

The interpolation operation equally spaces the selected data series by using a defined polynomial order interpolation to fit a smooth curve to existing data points.

Rate

The numerical frequency value used for the interpolation interval.

Method

The option to choose the polynomial fit order used for interpolation. Options include Linear, Quadratic and Cubic.

Calculation

The settings used to calculate a high resolution Periodogram of the selected data. The Periodogram splits the data into multiple overlapping windows (smaller data sets or sub-series) and performs a mathematical operation called a Fast Fourier Transform (FFT) on each sub-series.

Segment Duration

Time interval used for Variability Analysis calculations. The segment duration is different from the Logging Rate used in other areas of Ponemah.

Periodogram Resolution

The number of points used to calculate the Periodogram.

Windowing Method

The mathematics behind the FFT assumes that the input waveform repeats cyclically. This is not the case with most waveforms, so to avoid sharp discontinuities that would cause additional frequency components in the result, a windowing method is used. Windowing is used to taper the sub-series endpoints to better approximate a truly periodic signal. By tapering the window smoothly to zero at each end, the height of the side lobes resulting from a rectangular window can be diminished; this is achieved at the expense of a wider main lobe (coarser response at the true center frequency). Choose a windowing method to define how the time domain signal will be truncated. Options include:

- **Rectangle** - This windowing method does not modify the data signal and produces the sharpest spectral peaks, but produces the worst side lobes due to 'border artifact'.
- **Hanning** - Similar to a bell curve, this windowing method provides greater weighting for points in the center of the window. This is a good general-purpose window; however, it does remove most of the signal. If unsure about which window would be best, try this one first. In comparison with the rectangular window, it reduces border artifact by virtue of its smaller first side lobe amplitude. However, non-rectangular windowing affects the average power of a signal because some of the time samples are attenuated when multiplied by the window.
- **Hamming** - Similar to the Hanning window, this windowing method provides another way to taper endpoints of the sub-series and preserves more of the original signal than a Hanning window, but at the price of unpleasant side lobes. The Hamming window has slightly more attenuation in the first side lobe than the Hanning window, but the subsequent side lobes trail off more slowly than with the Hanning window.

Overlapping sub-series

Used to subdivide the data segment into smaller segments that are windowed individually to provide the desired frequency resolution. Values can be between 2 and 50.

Frequency Axis Range

Range of the x-axis to display the Periodogram data.

Detrend

Removal of any baseline wander in the data.

Suppress Mean

Removes the baseline offset so that all data averages to 0. Enabling this option helps to ensure precise statistical measures.

Normalize Result

Normalizes the Periodogram result so that the maximum y-axis value is equal to 1.

Frequency Bins

This function bins the Periodogram into user-defined frequency ranges. The power contained within each of the bins is determined and used for further analysis. The default values provided in the list are examples and may be adjusted.

Name

Name assigned to the frequency bin. Default values are shown, but can be changed by clicking within the box that contains the name.

Lower Limit

Numerical frequency value used for the Lower Limit for the specific frequency bin. The Lower Limit must be less than the Upper Limit. The value can be changed by clicking with the box that contains the Lower Limit value.

Upper Limit

Numerical frequency value used for the Upper Limit for the specific frequency bin. The Upper Limit must be greater than the Lower Limit. The value can be changed by clicking with the box that contains the Upper Limit value.

Color

Color used on graph pages for the specific frequency bin. The color can be changed by clicking on the color box.

Component

The Variability Analysis calculates parameters specific for HRV. In order for the calculations to perform correctly, the specific frequency components must be identified. Options are ULF, VLF, LF, HF and Unspecified. The Unspecified option is the only frequency option that can be used more than once. For the named frequency components the Upper Limit of VLF must be less than the Lower Limit for LF and the Upper Limit for LF must be less than the Lower Limit of HF.

Add

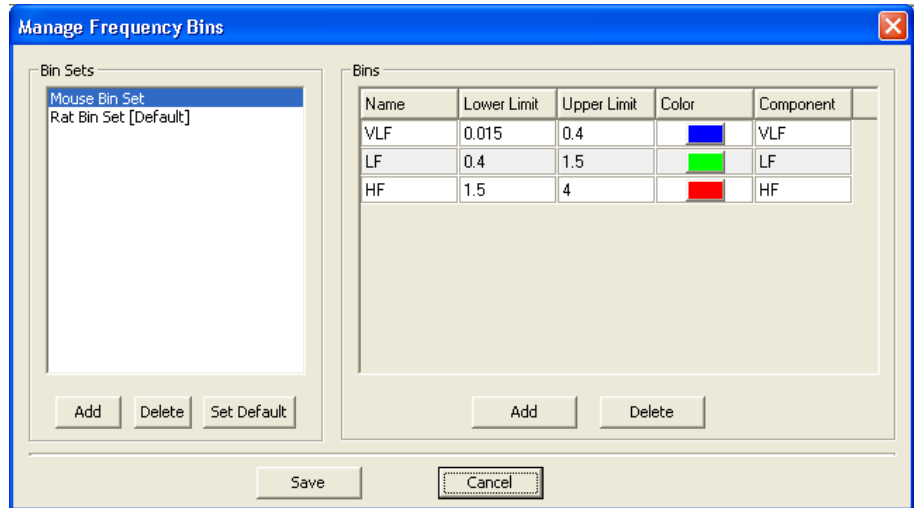
Used to add additional frequency bins.

Delete

Used to delete frequency bins.

Copy Bin Set

Click on the > to choose or manage the bin sets. Default mouse and rat bins are available for first time use. Choosing **Manage Bin Sets ...** will display the Manage Frequency Bins dialog.



Bin Sets

Displays the bin sets available for use. Mouse and Rat bin sets are available as defaults. Additional sets can be created. The default bin set used for calculations can be selected by clicking the **Set Default** button.

Derived Output

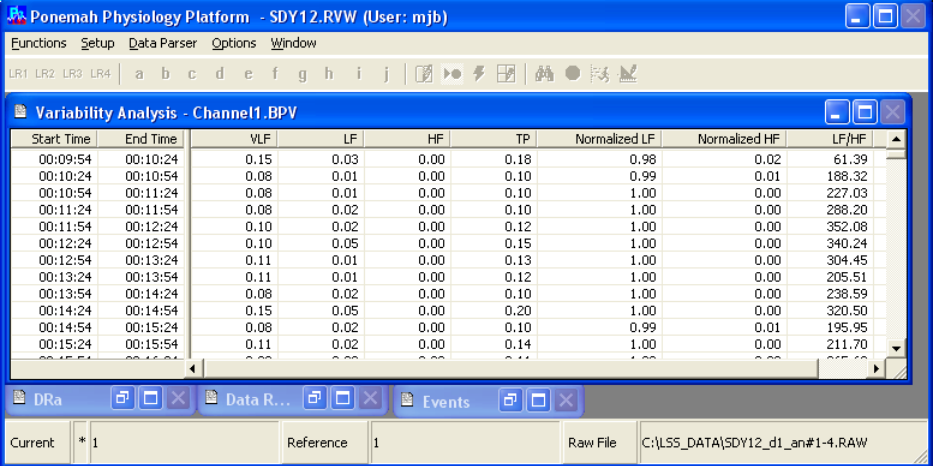
Derived output from the variability analysis operations is made available in the main Review window while in Review mode. The derived parameters will only be available if binned analysis was set-up during creation of the variability analysis. To enable the analysis the **Frequency Bins** check box, from the **Add Variability Analysis** dialog, must be selected. This will also allow the Periodogram and binned presentations to be selected in the **Graph Setup** dialog.

When derived data is saved, the derived output is also sent to Microsoft Excel or Access depending on the settings in the **ODBC Interface** configuration in the **Application Configuration** dialog. Derived data can be saved when saving a marks section (**Save Marks Section**) or by selecting the **Save Derived Data** option. Invalid or unknown data are represented as an 'x' in review. In ODBC unknown or invalid data are represented as 9.999e+15.

Unlike other derived output the variability derived data is saved to its own worksheet for the Excel output and a separate table for the Access output. In both cases the

worksheet and table is named based on the channel number and variability analysis name.

The numerical derived output is available via the Microsoft Excel OR Access output as a separate tab and 'table' respectively.



Start Time	End Time	VLF	LF	HF	TP	Normalized LF	Normalized HF	LF/HF
00:09:54	00:10:24	0.15	0.03	0.00	0.18	0.98	0.02	61.39
00:10:24	00:10:54	0.08	0.01	0.00	0.10	0.99	0.01	188.32
00:10:54	00:11:24	0.08	0.01	0.00	0.10	1.00	0.00	227.03
00:11:24	00:11:54	0.08	0.02	0.00	0.10	1.00	0.00	288.20
00:11:54	00:12:24	0.10	0.02	0.00	0.12	1.00	0.00	352.08
00:12:24	00:12:54	0.10	0.05	0.00	0.15	1.00	0.00	340.24
00:12:54	00:13:24	0.11	0.01	0.00	0.13	1.00	0.00	304.45
00:13:24	00:13:54	0.11	0.01	0.00	0.12	1.00	0.00	205.51
00:13:54	00:14:24	0.08	0.02	0.00	0.10	1.00	0.00	238.59
00:14:24	00:14:54	0.15	0.05	0.00	0.20	1.00	0.00	320.50
00:14:54	00:15:24	0.08	0.02	0.00	0.10	0.99	0.01	195.95
00:15:24	00:15:54	0.11	0.02	0.00	0.14	1.00	0.00	211.70

The start time and end time associated with the variability analysis output is based on the segment duration used during set-up.

The precision used in the output can be changed by changing the precision for the data channel associated with the variability analysis.

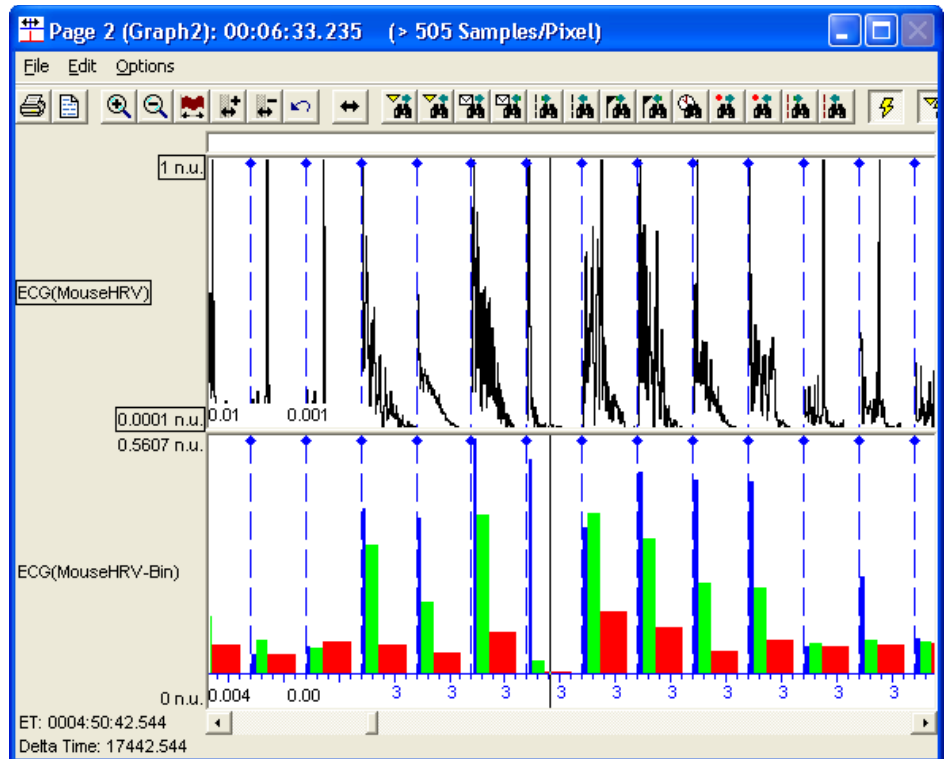
Note:	The derived output for Variability Analysis will show all data values as identified in the screen shot. It is not possible to hide any of the shown information.
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Graph Page Set-up

Results from Variability analysis can be shown graphically via Primary and Trend Graph pages.

High resolution periodogram and binned periodogram can be viewed in a primary graph. All derived variability analysis data can be viewed in trend graphs.

See the **Review Graph Pages** section in this manual for information on toolbars and graphical functionality.



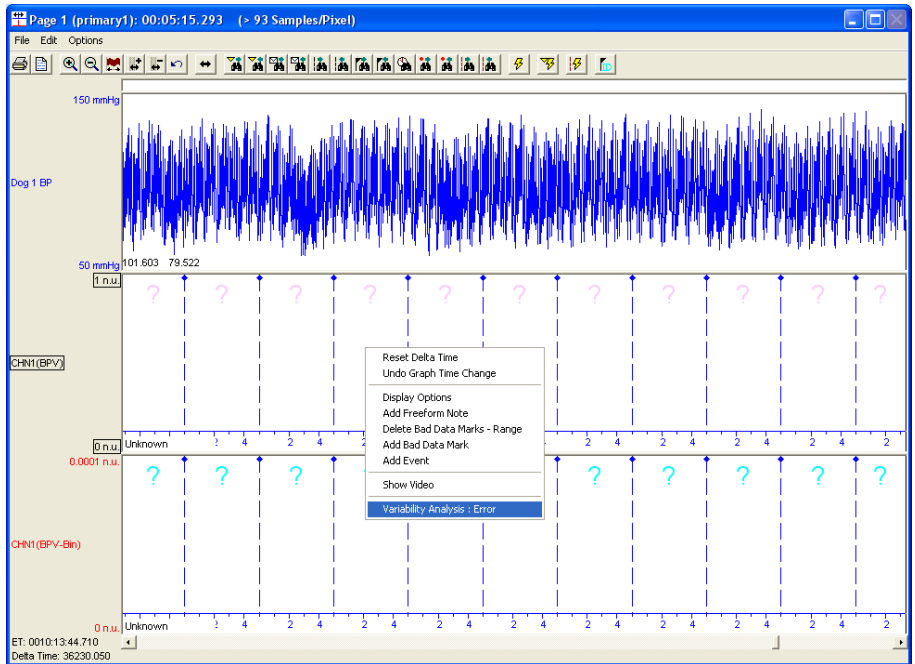
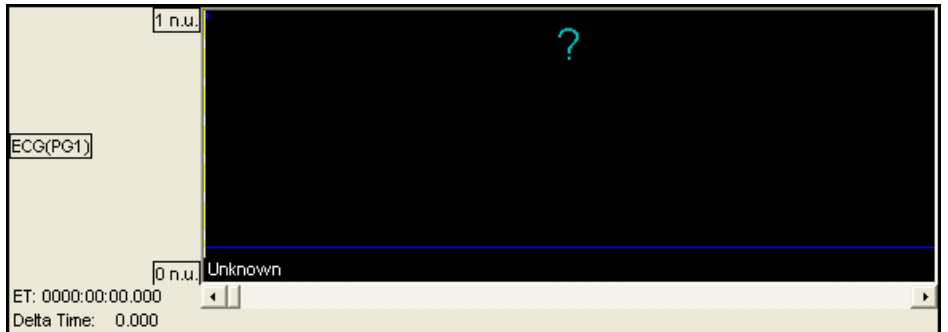
Note:	Print and Parser View Mode functionality is not available when graphing data from the Variability analysis.
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Trouble Shooting

In order for the variability analysis to work correctly it is important to include the analysis attributes for the ECG or blood pressure raw signal. If this is not done then the derived data and graph pages will not display the variability analysis data.

Ponemah will provide visual feedback regarding any potential errors related to variability analysis. The screenshots below provide an example for when no valid data points are available for the variability analysis. The error condition can also be verified by right clicking the mouse in the axis for the Periodogram or binned data. This is shown in the last screen capture.

Start Time	End Time	VLF	LF	HF	TP	Normalized LF	Normalized HF	LF/HF	*Status
13:23:20	13:23:50	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:23:50	13:24:20	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:24:20	13:24:50	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:24:50	13:25:19	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:26:20	13:26:50	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:26:50	13:27:20	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:27:20	13:27:50	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:27:50	13:28:20	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:28:20	13:28:50	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:28:50	13:29:20	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:29:20	13:29:50	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:29:50	13:30:20	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:30:20	13:30:50	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:30:50	13:31:20	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:31:20	13:31:50	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:31:50	13:32:20	x	x	x	x	x	x	x	PNM4604: No valid data points.
13:32:20	13:32:50	x	x	x	x	x	x	x	PNM4604: No valid data points.



Glossary of Terms

Log File

A LOG file is created whenever a marks section is saved. The LOG file name is formed from the review file name and the marks section name. The LOG file lists the Protocol settings at the time the marks section was saved and all changes to the marks section including reasons for the changes. When attributes are changed over a specific range, the log file will list the attribute modifications and the range over which the changes were made instead of every mark movement. If individual marks are moved, they will still be listed separately.

