OpenScope User Guide

Data Visualization



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Table of Contents

OpenScope Overview

4
6
12
24
26
29
57

OpenScope Overview

OpenScope User Guide

OpenScope is a user-customizable display and analysis application. OpenScope can display stored data dynamically during the course of an experiment or the entire experiment can be replayed later as if the data were just being acquired.

Before You Begin

Installation

OpenScope is included with Synapse and TTankMin.

About OpenScope

OpenScope is a flexible display application for visualization of data stored in the DataTank format. A wide variety of plot types and settings provide you the ability to view the desired data in the most useful way.

OpenScope provides eight customizable plot types including: pile, scroll, raster, XY, feature, chart, histogram, and activity. A single OpenScope file can include a variety of multi-view and single channel plot types to display different types of data. For even greater flexibility, several OpenScope windows, each viewing data from a different data tank, can be opened simultaneously.

As part of Synapse, OpenScope can be used on any computer with local or network access to the data tank. This provides users the ability to share information across a network.

Getting started with OpenScope begins with selecting data. If you launch OpenScope from Synapse, this is done automatically based on what is selected at the time. If you launch OpenScope directly, you will need to browse to locate the data tank. Once the data tank has been identified plots can quickly be added and customized to meet a variety of research needs.

About Adding Plots

The Auto-Generated Flow Plot An auto-generated Flow Plot can be added by dragging a Block from the Block list to the grid. The Flow Plot will contain a plot for each data event (or Store) found in the block.

Individual Plots Individual plots can be added to the grid area by dragging a data event to the grid or by using the Add Plot command on the Edit menu. Either option provides several plot types to choose from. See the Plot Types for step-by-step instructions for adding specific plot types.

Workspace Basics

About the OpenScope Workspace

The OpenScope workspace includes four collapsible sub-windows and a main grid area where plots can be displayed.



OpenScope Main Workspace

Using the Tank Select Window

The Tank Select window allows you to identify the data to be plotted. Before you can plot data the tank containing the data must be selected. Users can create plots by dragging a data event to the grid area.

The window is divided into three areas: TANK, BLOCK, and EVENT. Right-clicking an area displays a shortcut menu that includes common commands.



The TANK area lists tanks that have been 'registered' and the currently active tank. You can register a tank so it appears in this list the next time OpenScope runs by right-clicking on the tank name and selecting 'Register Tank' from the dropdown menu.

The BLOCK area displays the blocks available in the tank selected in the Tank area. The Details view displays a name, date, starting time, duration, and stop time for each block of data in the selected tank. Drag the block name into the grid area to recreate the Flow Plot from that recording.

The EVENT area displays information about events for the block selected in the BLOCK area. Details include event type, data format, and sampling rate. Drag an event to the grid are to create a plot using just that data.

The Tank Select dialog can also be accessed from the File > Data Source menu.

Controlling Data Visualization



The Control Window provides controls for animating stored data or tracking data as it is acquired. Both methods read data from the tank; however, tracking ensures that the most recently stored data is being viewed during a live recording.

When tracking data, animation speed settings and block selection

are not needed and are unavailable. Animation Speed choices include: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, Normal, x2, x4, x8.

Using the Time Control Window

The Time Control window provides a timeline and vertical line indicator that moves as data is animated. Epochs, or indexed events, are also added to the window. The Time Control Window can be used to move to a particular time or event by clicking on it.

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Timeline by Time Stamps





Timeline by Events



Shortcut Menus

The following context sensitive menus are available by right-clicking the corresponding area of the Select Tank window.

TANK Shortcut Menu

Option	Description
Browse for Tank	Browse for tank folder
Create New Tank	Opens the Create Data Tank dialog box so that a tank can be added
Register Tank	Adds the selected tank to the registry so it will be available next time you run OpenScope without browsing for it
Unregister Tank	Removes the selected tank from the registry. The tank can still be used
Test Tank	Tests the connection to the server and opens and closes the tank file
Reset Tank	Resets the selected tank file. This option returns the tank file to a state in which data can be read from or written to the tank
Show Full Path	Toggles detail view on and off. In details view the path to the tank is displayed
Refresh Tank List	Refreshes the Tank box display
Show Legacy Tanks	Displays registered legacy format tanks in the tank list from OpenEx version 1.x
Find Legacy Tanks	Browse for OpenEx version 1.x tank files

BLOCK Shortcut Menu

Option	Description
Refresh	Refreshes the Block box display
Details	Toggles detail view on and off. In details view the date, the date, starting time, duration, and stop time of each block is shown
Sort	Orders the blocks by Name
Information	Shows a dialog that contains detailed event information

EVENT Shortcut Menu

Option	Description
Details	Toggles Details view on or off. Details view includes: event type (such as stream, snip, or strobe), data format (such as float, integer, or double), nSize (number of samples per acquired event), Fs (sampling frequency)

OpenScope Menus

OpenScope File Menu

Name	Description
New	Creates a blank OpenScope configuration file (*.xsp)
Open	Open an existing OpenScope configuration file
Data Source	Opens the Tank Select dialog. This Tank Select dialog box is similar to the Tank Select window but allows the user to select tank server if connecting across a network ^

* If attempting to connect to a tank server to read live data as it is recorded across a network, see Tech Note TN0954

OpenScope Edit Menu

Name	Description
Cut	Cuts the selected plot or plots
Сору	Copies the selected plot or plots
Paste	Pastes the most recently cut or copied plot or plots
Paste Special	Pastes a new plot type using the data source from the most recently cut or copied plot
Add Plot	Opens a sub menu of plot types. Clicking a plot type adds a blank plot of that type to the grid area
Remove Selected Plot	Removes the selected plot (no undo)
Group	Groups selected plots so that they can be labeled and moved together
Ungroup	Ungroups plots in a selected group
Preferences	Opens the Setup Preferences dialog box to customize the appearance of the grid area

OpenScope Control Menu

Name	Description
Animate	Animates plots with data in the block selected in the Tank Select window
Track Active	Animates plots with tracked data
Halt	Stops animation or tracking

OpenScope View Menu

Name	Description
Toolbar	Toggles the toolbar between displayed and hidden
Status Bar	Toggles the status bar between displayed and hidden
Tank Navigator	Toggles the Tank Select window between displayed and hidden
Control Window	Toggles the Control window between displayed and hidden
Message Window	Toggles the Message Window between displayed and hidden
Notes Window	Opens the List of Epoch Notes window and enables data annotation
Time Navigator	Toggles the Time Control window between displayed and hidden
Show Epocs On Time Navigator	Toggles the graphical display of epocs on the time navigator. Turn this off to improve performance for long recordings with lots of epoc events
Verbose Messaging	Toggles verbose messaging on and off
Video Viewer	Toggles open/close the Video Viewer window
Overlay Time Stamps	Display the current time on the Video Viewer as a subtitle
Select Video Source	Selects RV2 source of video for VideoViewer if not using a video file saved in the currently selected block
Customize Toolbars	Opens the Customize dialog box to customize the appearance of the menu bar and toolbar

OpenScope Help Menu

Name	Description
About OpenScope	Displays version and copyright information for OpenScope

Epoch Annotation

Epoch Annotation allows user to add notes to a block of data. An epoch store is selected for data marking and storage and an index integer is associated with each note text string. When a note is placed in the data, the corresponding integer value is associated with the timestamp for the corresponding epoch event and is stored with the epoch data in the tank. The list of notes and the text string for each are automatically saved into a *.tnt file in the block directory.

Setup

Entering Annotation Mode

The annotation tools are part of OpenScope's Flow Plot— the only plot type that supports annotation. The Flow Plot must be added to the workspace and data must be loaded to the plot before the annotation tools are available.

To generate the Flow Plot:

• Drag a Block from the Block list to the grid.

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Ready				

Data may be viewed through animation, clicking the timeline to a specific location, or using the left/right arrow keys to move the timeline one full timespan.

To enter annotation mode:

Click the View menu and click Notes Window.



The List of Epoch Notes window opens.

List of Epoch Notes					
Record Mode Find First Note Save Load Import Fill In					
Index	Notes				
Add					

The List of Epoch Notes window is a floating window and can be moved as needed. It must remain open while working with the animation tools.

Loading Epoc Data

When the Notes Window is open and data has been loaded to the plot, a shortcut menu (rightclick) is available in the data area of an epoch store in the plot.

To load data to the plot:

• Click the Animate button then click the button again to stop animation.

If there is only one epoch store in the dataset, a red arrow appears next to the epoch's name in the plot.

The Tick epoch, a simple timing marker that fires every second, is present in most datasets and is a convenient epoch for annotation, so it is used in this example. Camera frame epoc events (e.g. Cam1 or Vid0) are also commonly used.

If there is more than one epoch in the dataset, specify the note epoch:

1. Right-click the data area of the plot for the desired epoch.



2. Click Set Note Epoch on the shortcut menu.



A red arrow appears next to the epoch's name in the plot.

Viewing Data to be Annotated

Users can preview or view the data to be annotated either by using OpenScope tools to animate the data or by stepping through the data one timespan (visible screen) at a time.

To step through the data:

• Press the **right arrow key** or **left arrow key** on the keyboard to jump forward or backwards in the data one full timespan.

This technique works in both manual or animated mode.

Creating a Note

New notes strings can be added in the List of Epoch Notes window or directly on the Flow Plot as a note is set.



The Note Epoch must be specified before creating notes, see Loading Epoc Data above.

If you know what notes will be used, then create the note list before you start annotating.

To create a new note without setting a note in the data:

- 1. In the List of Epoch Notes window, click the **Add** button or double-click the blank note field to open the dialog.
- 2. In the Note field, type a text string.



The note string can be multi-line. After the note is added, the line breaks are represented with a pipe '|' character in the Notes description and in the corresponding text file.

3. Click the Add button.

🔳 List	of Epoch Notes	\times
Reco	rd Mode Find First Note Save Load Import Fill In	
Index	Notes	
1	Sleep	
Add		

An **Index** integer is associated with the new note string and it is added to the list of epoch notes. The text string is automatically appended to a *.tnt text file in the block directory.

To create a new note while setting the note in the data:

Note
Data must be loaded to the plot before the annotation shortcut menu is available.

1. Right-click to the right of the desired location in the epoch data and click **Set Note** on the shortcut menu. Note: The annotation algorithm locates the most recent event (looking backward in time) and associates the note with it.



2. In the Note field, type a text string.

Epoch Notes: Set note at 13.001195 for Tick.	×
Note Index: new	Set
Note:	Cancel
Awake	^
]	¥

3. Click the Set button.

▶ ∥ 《	$\langle \rangle \rangle$	🔆 🛃 🗸	5		
Tick	11	12	13 2	14	15

An Index integer is associated with the new note and set in the data at the time/position of the most recent instance of the Epoch event. The integer is displayed a white numeral above the data on the right side of the time bar and its value is stored with the epoch data in the tank.

🔳 List	of Epoch Notes	Х
Reco	rd Mode Find First Note Save Load Import Fill In	
Index	Notes	
1	Sleep	
2	Awake	
Add		

The newly added note is highlighted in red in the List of Epoch Notes window and the text string for the new note it is appended to a *.tnt text file in the block directory.

Users can continue to add notes in the List of Epoch Notes window until all the desired notes have been added and/or add notes on-the-fly using the annotation shortcut menu.

To set an existing Note Index in the data.

1. Right-click to the right of the desired location in the epoch data and click **Set Note** on the shortcut menu.

₂ Select an integer from the **Note Index** drop-down menu.

Epoch Notes: Set note at 13.001195 for Tick.	×
Note Index: 1	Set
Note: 1	Cancel
Sleep	^
]	\vee

- 3. Click the Set button.
- 4. Users can step through the data using the right and left arrow keys, to continue annotating, or use OpenScope animation.

Rapid Annotation With Keypad

Users can quickly annotate data by pressing number keys (1-9) either while the plot is animating or while frozen. The arrow keys can be used to move back and forth on the timeline in both modes.

You can set a time delay so that notes will be set at some time before the position of the white vertical time bar when the key was pressed. This accounts for user delay while pressing the number keys during playback review.

The red arrow at the top of the plot indicates the timestamp relative to the solid white bar where a new note will be recorded when the keypad number is pressed.



New notes added will overwrite any note already set at the same event timestamp.

To set a note delay:

• Right-click the data at the timestamp where you want the top red arrow to display and choose Set Note Delay to move the arrow to that location. Once the delay is set, it will be used for all notes set during animation.



To annotate:

Before annotating data, ensure that the List of Epoch Notes window is open, the Note Epoch has been set, and the necessary notes have been created.

1. In the List of Epoch Notes window, select the **Record Mode** box at the top left of the window.

🖳 List o	of Epoch Notes X
	rd Mode Find First Note Save Load Import Fill In
Index	Notes
1	Sleep
2	Awake
3	Chewing
4	Running
Add	

- 2. Click the **Animate** button in the OpenScope controls to animate the data, or press the arrow keys to move to the desired location.
- 3. Press the number key corresponding to the integer Note Index for the desired note.
- 4. The note is added, indicated by a white number in the display and that note is highlighted red in the notes list.
- 5. Continue adding notes until annotation is complete.

When in animation mode, users can use OpenScope controls to speed-up or stop animation.

olmportant 💧

It is recommended that users do **not** use the Flow Plots 'Play' and 'Pause' buttons during annotation. The Pause button freezes the plot, but animation continues in the background. Pressing the Play button re-starts the plot at the current point according to the animation, **not** where the plot was frozen. If more than one time span of data has passed, this can lead to overlooking some sections of the data.

Reviewing and/or Revising Annotated Data

Users can review and revise epoc note placements as needed. There are a few extra tools that can help in this process.

To locate existing notes:

• The note list temporarily highlights a note blue when that note is passed in the Flow Plot. This is true when stepping through the data or animating data. It can speed up a search for existing notes or be useful in avoiding overwriting existing notes during animation.

To remove a single note:

 Right-click the desired note marker in the plot and click **Remove Note** on the shortcut menu.

To remove all notes in the block:

• Right-click the data area for the Note Epoch and click **Remove Block Notes** on the shortcut menu.

To quickly set the note epoch for a previously annotated block:

 Click the Find First Note button in the List of Epoch Notes window. OpenScope searches the current block for the first note, and then performs 'Set Note Epoch' on that epoch event. This is useful for reviewing previously annotated data when the epoch used for scoring is not known.

To save a list of all note indices in the block, along with their time stamp, to a text file:

Click the Save button in the List of Epoch Notes window. The data is saved to a text file
 (*.nxt) that can be loaded back into the block later, if necessary.

To load a previously saved (*.nxt) list of notes into the block:

- 1. Click the **Load** button in the List of Epoch Notes window. The Load saved notes window opens.
- 2. Browse to and load an existing .nxt file.



This overwrites the current note data for the block.

To import an existing Notes list:

Click the Import button in the List of Epoch Notes window. Browse to and load an existing
 *.tnt file from another block. The list of note strings are imported into the current block
 list. This makes it easier to have a consistent note list across multiple blocks.

Filling in Notes

Notes mark a single event or a change in state at a particular time. When users want every event to be marked with the current state (such as asleep or awake) the 'Fill In' option can greatly speed up annotation. It allows users to add notes when the state changes, then go back and fill in every subsequent event, until the next state change, with that note index. This is useful when the user wants all epoch events from the time of the note until the next change to be returned when later reading the data into MATLAB or Python.

To fill in (add notes to all events in the store):

1. Begin with a block of data that has the state changes annotated. It is a good idea to back-up the notes data at this point, in case you need to revert to this point later. Click the Save button in the List of Epochs Notes window to save the notes.



2. Click the **Fill In** button in the List of Epochs Notes window.



A note is added to any epoch event that does not already have a note associated with it. For each event, the previous (or most recent) note index is used.

Using the Video Viewer

The Video Viewer provides synchronized playback of video files while reviewing data in OpenScope. Click the **View** menu then click **Video Viewer** to add the Video Viewer window to the OpenScope Display.

When you select a new block that includes an epoch store with the name Vid{N} or Cam{N} (where {N} is any number 0-9), OpenScope attempts to find a properly named AVI file in the block folder. The video file name must include the correct block name and store name, e.g. DemoTank2\Block-1\Vid0.avi, DemoTank2\Block-1\Cam1.avi, or DemoTank2\Block-1\Cam1.mp4. This is the default naming scheme for videos recorded on the RV2, USB Camera HAL in Synapse, and iV2 iCon module in Synapse, respectively.

OpenScope will open video files in Video Viewer windows, one for each video found (up to 8). A subtitle file containing video timestamps is also opened and timestamps are overlayed on the video window. This can be disabled by toggling the View > "Overlay Time Stamps" menu option.

The example window below shows a video recorded for demonstration purposes. The video and plot are synchronized with the timeline during animation.



Note for RV2 users

The AVIs should be stored with the rest of their respective block files whenever possible. This allows the RV2 to continue recording video data while the user reviews previously recorded AVIs. It also removes any network communication delays. The RV2 file structure makes it easy to merge entire tanks of AVIs directly into the locally stored tank.

When the AVI is not found locally, the Select Video Source dialog shows all available RV2s on the local network. You can choose a specific RV2 and check the 'Use as default and do not show this dialog' option so that RV2 is always used for network playback.

To change the default RV2, click the View > Select Video Source menu option.

Using Epochs with OpenScope

OpenScope uses epochs to organize and display data. Epochs are stored events that are associated with a block's timeline.

Epochs serve two main functions:

- To display data in groups so that each group is associated with a particular event.
- To change or refresh the plot in response to changes in an event.

Plot settings related to epoch events can be found in the Refresh Control and Behavior parameter groups in a plot's property settings dialog box.

Refresh Control: All plots have refresh control settings that allow the user to define a refresh epoch. When a refresh epoch event is defined the plot will be refreshed based on the epoch value according to the settings in the Refresh Control parameter group. To learn more about the settings see Refresh Control Parameter settings.

Behavior: Histogram and raster plots use a time reference epoch event to sort and display data and to determine what data is plotted according to settings in the Behavior parameter group. To learn more about the settings see Histogram Behavior Parameter settings or Raster Behavior Parameter settings.

The Refresh Control and Behavior settings can be used independently or in combination. Because different epoch events can be selected for the Refresh Control and Behavior, the data can be refreshed by a value that is independent of the time reference epoch. This behavior allows users to develop several graphs each associated with a unique event. Data can then be compared across event parameters.



Raster Plots with Different Behavior Settings

The OpenScope plots show two raster plots that differ in their behavior. The top plot displays all the data and the bottom plot displays only data in events that have the value 9000. The difference between the two plots is how the behavior settings use epoch events. In the bottom plot the behavior of the plot is controlled by setting limits on the range of epoch events that are displayed.

Using Refresh Control Settings

Refresh Control settings determine when displayed data is removed from the display. Epoch events can be used to control what set of data is shown on screen. For example, a pile plot can be set to remove old data and show only new data each time the epoch event changes. This would allow users to examine spike patterns that are associated with an event, such as a single stimulus event.

To view data for a single event value at a time:

- 1. In the plot's **Refresh Control** parameter group settings, in the **Refresh Epoch Name** box, select the desired epoch event.
- 2. Enter the high and low epoch values for the range over which the plot should refresh in the **Strobe Epoch Low Range** and **Strobe Epoch High Range** boxes.
- 3. Select the **Refresh on Change** check box. If Refresh on Change is not selected old data is removed and new data is displayed on each epoch within the boundary conditions set by Strobe Epoch Low Range and Strobe Epoch High Range.

In many cases the user might want to refresh on a particular event. For example, if an experiment calls for ten presentations of the same stimulus; after the last stimulus, the stimulus can be updated. If the stimulus number is included as an epoch then the plot can be refreshed when the stimulus number reaches a certain value.

Using Behavior Settings in Raster and Histogram Plots

Behavior settings determine how data is displayed, and what data is displayed, in a plot. When an epoch event is defined for a Raster or Histogram plot only the data associated with the epoch's scalar values will be displayed. For example, if a user wants to display only signal responses that occur when a particular stimulus is presented, such as a 9 kHz tone, the plot behavior can be set so that a new raster pattern is displayed only when this event occurs.

Plot Types

Selecting Data

Before you can plot data, the tank and block within the tank must be selected in the Tank Select window of OpenScope.

To select data from a tank:

- 1. Click the tank name in the TANK area of the Tank Select window.
- 2. Click the block name in the **BLOCK** area of the **Tank Select** window. The events contained in the selected block will be displayed in the **EVENT** area.

note

Most tanks created in Synapse do not show up in the Tank Select window until you have first browsed to them. You can add them to the registry to make them appear automatically.

After data is selected, plots can be created using the selected data.

Creating the Auto-Generated Flow Plot

The easiest way to quickly view data is using the basic Flow Plot.

To generate the Flow Plot:

• Drag a Block from the Block list to the grid.

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BLOCK: Name					
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			-		
Animate Track					
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< > 0.000	187.1	374.2	561.3	748.4	935.5 >>k< <<>>>
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Ready					

The Flow Plot is the same as the Synapse Flow Plot and contains the most common plot type for each Store in the data set.

Creating Pile Plots

Pile plots are designed to visualize small data buffers (< 500) for quick recognition of differences in waveform properties. Pile plots are commonly used when extracellular recordings from neurons are examined to separate out single-unit activity. Users can use pile plots to view time stamped buffers, called snippets, or synchronized buffers. In a pile plot, the Y-axis is signal intensity such as voltage or dB and the X-axis is the record size in samples. Waveforms are layered over one another and centered along the X-axis. As the buffers pile up differences in the shape of the waveforms can easily be distinguished.

To quickly create a pile plot for a single channel of the selected data:

1. Drag a data event from the Tank select window to the grid area. The Select Plot Type box opens.



2. Click **Pile**. The pile plot is added to the grid area and the Setup Properties dialog box opens with the most commonly used settings for the pile plot displayed.

50	etup Properties for Pile	Plot	×	
	Parameter Group	Common	•	
	Source Name	Snip		
	Source Channel	0	÷	
	Pile Depth	30		
	Multi View Enabled			
	Num Views	1	÷	
	Num Columns	1	+	
	Category Coloring	By Channel	-	
Cancel OK				

3. Related settings are grouped together by color. Other settings are available by clicking the **Parameter Group** box and selecting a settings group.

- $_{\mbox{4}}\,$ In the $\mbox{Source Channel}\,$ box, enter the desired channel number.
- 5. In the **Pile Depth** box, enter the minimum number of wave forms to be displayed. The plot will be refreshed when the number of traces reaches twice the minimum.

6. Click OK.

The pile plot is configured for viewing a single channel of data. The plot can be positioned and resized using the mouse. When you animate or track data the plot will look similar to this:



After a single channel pile plot has been created, the settings can be quickly modified for multichannel viewing.

To modify a pile plot to view multiple channels of data:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. In the Source Channel box, enter 0 to ensure that all channels are available for viewing.
- 3. Select the Multi View Enabled check box.
- 4. In the **Num Views** box, enter the total number of views required to see all available channels of data in the multi view. This number will typically be the number of channels of data acquired. By default channels will be displayed beginning with channel 1.
- 5. In the **Num Columns** box, enter the number of columns to display.
- 6. Click OK.

When you animate or track data the plot will look similar to this:



After a multi-channel pile plot has been created, the settings can be quickly modified for viewing a range of channels.

To modify a pile plot to view a range of channels:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. Enter the total number of channels of data to be viewed in the Num Views box.
- 3. By default channels will be displayed beginning with channel 1. To display multiple channels beginning with another channel, modify the index offset.
- 4. To modify the index offset value, click the Parameter Group box, and click Multi View.
- 5. In the View Index Offset box, enter the number of channels to offset.



For example, to begin viewing from channel 6, enter an Index Offset value of 5. The plot will begin with channel 6 and display the next sequential channels to equal the number entered in the Num Views box.

6. Click OK.

When you animate or track data the plot will look similar to this:



Creating Scroll Plots

Scroll plots provide a useful means of looking at continuous data. Data is presented in segments called scrolls. Looking at one scroll after another gives an effect similar to an oscilloscope or EKG. In a scroll plot the Y-axis is voltage and the X-axis is the record size.

To quickly create a scroll plot for single channel of the selected data:

1. Drag a data event from the **Tank Select** window to the grid area.

Select Plot Type Select Plot

The Select Plot Type box opens.

2. Click Scroll

3. The scroll plot is added to the grid area and the Setup Properties dialog box opens with the most commonly used settings for the scroll plot displayed.

Setup Properties for Scroll Plot				
	Parameter Group	Common		
	Source Name	eNeu .		
	Source Channel	0	÷	
	Scroll Sections	10	÷	
	Multi View Enabled			
	Num Views	1	•	
	Num Columns	1	-	
	Confine plotting data in cell	Z		
	Plotting margin percentage	0	•	
	Cancel	OK		

- 4. Related settings are grouped together by color. Other settings are available by clicking the **Parameter Group** box and selecting a **settings group**.
- 5. In the Source Channel box, enter the desired channel number.
- 6. Enter the desired number of scrolls, or data segments, to be displayed.
- 7. Click OK

The scroll plot is configured for viewing a single channel. The plot can be positioned and resized using the mouse. When you animate or track data the plot will look something like this:



After a single channel scroll plot has been created, the settings can be quickly modified for multi-channel viewing.

To modify a scroll plot to view multiple channels of data:

1. Double-click the plot to display the **Setup Properties** dialog box.

- $_2$ In the Source Channel box, enter **0** to ensure that all channels are available for viewing.
- 3. Enter the desired number of scrolls, or data segments, to be displayed.
- 4. Select the Multi View Enabled check box.
- 5. In the **Num Views** box, enter the total number of views required to see all available channels of data in the multi view. This number will typically be the number of channels of data acquired. By default channels will be displayed beginning with channel 1.
- 6. In the **Num Columns** box, enter the number of columns to display. Leave this value set to 1 to see one channel per row.
- 7. Click OK.

After a multi-channel scroll plot has been created, the settings can be quickly modified for viewing a range of channels.

To modify a scroll plot to view a range of channels:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. In the Num Views box, enter the total number of channels of data to be viewed. By default channels will be displayed beginning with channel 1. To display multiple channels beginning with another channel, modify the index offset.
- 3. To modify the index offset value, click the Parameter Group box, and click Multi View.
- 4. In the **View Index Offset** box, enter the number of channels to offset. For example, to begin viewing from channel 5, enter an Index Offset value of 4. The plot will begin with channel 5 and display the next sequential channels to equal the number entered in the Num Views box.
- 5. Click OK

When you animate or track data the plot will look like similar to this:


Creating Histograms

Histograms use time stamped values from a variety of data Stores for graphic presentation. The most common of these are snippets, but lists and even scalars can be included as long as a time stamp is part of the acquired value. Users set up the bin size (size of time divisions for sorting the time stamps) and the parameters for refreshing the plot.

A common plot in neurophysiology is the peristimulus histogram, or PSTH. This plot shows the distribution of spike times after a stimulus has been presented. Another plot might show spike times for a particular epoch event such as a signal of particular intensity and a final plot might compare spike patterns across channels over the entire experiment.

Histogram plots in OpenScope show the distribution of waveform time stamps over a set time span. Histogram plots can show additive changes over a set time scale or they can be refreshed over a set range. In addition, the plots can refresh (start from zero) at each epoch or on changes in an epoch (such as a change in the intensity of a stimulus).

This view provides a good visual representation of how waveform time stamps are distributed from the start of a stimulus.

To quickly create a histogram plot of for a single channel of the selected data:

1. Drag a data event from the **Tank Select** window to the grid area. The Select Plot Type box opens.



2. Click Histogram

The histogram plot is added to the grid area and the Setup Properties dialog box opens with the most commonly used settings for the histogram plot displayed.

5 6	etup Properties for Histog	gram Plot	×
	Parameter Group	Common	•
	Source Name	????	
	Source Channel	0	+
	TimeRef Epoc Name		
	Time Span	0	
	Bin Width	0.01	
	Multi View Enabled		
	Num Views	16	+
	Num Columns	4	+
	Category Coloring	By Channel	•
	Cancel	OK	

3. Related settings are grouped together by color. Other settings are available by clicking the **Parameter Group** box and selecting a **settings group**.

- 4. In the **Source Channel** box, enter the desired channel number. Channel selection is affected by the Index value on the Devices page and by the Store Chan Offset value on the Stores page.
- 5. In the **TimeRef Epoc Name** box, select an epoch, or indexed, event. This must be selected to update the histogram.
- 6. In the **Time Span** box, enter the desired time span. This might be set to the length of a stimulus, for example. In the Time Span box the time span can be fixed by the user or left set to 0 to respect the TRef duration. If the epoch is a stimulus this will allow you to see how waveform times are distributed from the start of the stimulus.
- 7. In the **Bin Width** box, enter the bin width. The bin width should relate to the distribution pattern of the time stamped signals. For a PSTH this might mean that the bin width should be a couple of milliseconds, for patterns of evoked potentials it could be much larger.
- 8. Click OK

The histogram plot is configured for viewing a single channel. The plot can be positioned and resized using the mouse. When you animate or track data the plot will look similar to this:



After a single channel histogram plot has been created, the settings can be quickly modified for multi-channel viewing.

To modify a histogram plot to view multiple channels of data:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. Enter **0** in the Source Channel box to ensure that all channels are available for viewing.
- 3. Select the Multi View Enabled check box.
- 4. In the **Num Views** box, enter the total number of views required to see all available channels of data in the multi view. This number will typically be the number of channels of data acquired. By default channels will be displayed beginning with channel 1.
- 5. In the **Num Columns** box, enter the number of columns to display. Depending on the design of your experiment you might want to view a pattern that is representative of the physical or logical distribution of the channels. For example, if you had electrodes placed in a 4 x 4 grid

around the head then it would be useful to see that pattern in OpenScope. Similarly, if you had electrodes in a linear pattern you might want to have either 1 column or 16 columns.

6. Click OK

When you animate or track data the plot will look similar to this:



After a multi-channel histogram plot has been created, the settings can be quickly modified for viewing a range of channels.

To modify a histogram plot to view a range of channels:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. In the **Num Views** box, enter the total number of channels of data to be viewed. By default channels will be displayed beginning with channel 1. To display multiple channels beginning with another channel, modify the index offset.
- 3. To modify the index offset value, click the **Parameter Group** box, and click **Multi View**.
- 4. In the View Index Offset box, enter the number of channels to offset.



For example, to begin viewing from channel 5, enter an Index Offset value of 4. The plot will begin with channel 5 and display the next sequential channels to equal the number entered in the Num Views box.

5. Click OK

After a multi-channel histogram plot has been created, the settings can be quickly modified to view by sort code.

To modify a multi-channel histogram plot to view by sort code:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. Click the Parameter Group box, and click Multi View.
- 3. In the View By box, select Sort Code from the drop down list.
- 4. Update the Num Views and View Index Offset values as needed.
- 5. Click OK

Creating Raster Plots

Raster plots provide a useful means of looking at time stamped values or waveforms that are not continuous, such as snippets. The time stamps of the snippets are represented by dots plotted in rows. Each row represents an epoch, or indexed, event. In a raster plot the Y-axis is indexed event values and the X-axis is time stamp values.

This view provides a good visual representation of when snippets occurred for an indexed event. Raster plots are an excellent way of detecting subtle changes in the timing of waveforms across channels.

To quickly create a raster plot for a single channel of the selected data:

1. Drag a data event from the **Tank Select** window to the grid area.

The Select Plot Type box opens.



2. Click Raster

3. The raster plot is added to the grid area and the Setup Properties dialog box opens with the most commonly used settings for the raster plot displayed.

50	tup Properties for Raster	Plot	×
E	Parameter Group	Common	•
	Source Name	????	
	Source Channel	0	-
	Raster Rows	10	-
	TimeRef Epoc Name		
	Time Span	0	
	Multi View Enabled		
	Num Views	16	
	Num Columns	4	
	Category Coloring	By Channel	•
	Cancel	ОК	

- 4. Related settings are grouped together by color. Other settings are available by clicking the **Parameter Group** box and selecting a **settings group**.
- 5. In the **Source Channel** box, enter the desired channel number.

- 6 In the **Raster Rows** box, enter the desired number of rows to be displayed.
- 7. In the **TimeRef Epoc Name** box, select an epoch, or indexed, event. This will define the Y-Axis.
- 8. In the **Time Span** box, enter a time stamp value for the maximum value of the X-axis. This value should usually be the time span of the indexed event, according to the time stamp.
- 9. Click OK

The raster plot is configured for viewing a single channel. The plot can be positioned and resized using the mouse. When you animate or track data the plot will look like this:



To modify a raster plot to view multiple channels of data:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. In the **Source Channel** box, enter **0** to ensure that all channels ar available for viewing.
- 3. In the **Raster Rows** box, enter the desired number of rows to be displayed. Enter 1 to view one row per channel for a clear comparison across channels for a single event value.
- 4. Select the Multi View Enabled check box.
- 5. In the **Num Views** box, enter the total number of views required to see all available channels of data in the multi view. This number will typically be the number of channels of data acquired. By default channels will be displayed beginning with channel 1.
- 6. In the Num Columns box, enter the number of columns to display.
- 7. Click OK

To modify a raster plot to view a range of channels:

- 1. Double-click the plot to display the Setup Plot dialog box.
- 2. In the Num Views box, enter the total number of channels of data to be viewed.
- 3. By default channels will be displayed beginning with channel 1. To display multiple channels beginning with another channel, modify the index offset.

- ⁴ To modify the index offset value, click the **Parameter Group** box, and click **Multi View**.
- 5. In the **View Index Offset** box, enter the number of channels to offset.
- 6. For example, to begin viewing from channel 5, enter an Index Offset value of 4. The plot will begin with channel 5 and display the next sequential channels to equal the number entered in the Num Views box.
- 7. Click OK

To modify a multi-channel raster plot to view by sort code:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. Click the Parameter Group box, and click Multi View.
- 3. In the View By box, select Sort Code from the drop down list.
- 4. Update the Num Views and View Index Offset values as needed.
- 5. Click OK

Creating XY Plots

XY plots provide a useful means of looking changes in two continuously varying values. In OpenScope, the Y-axis and the X-axis are selected from available data events. The XY plot can be used to plot positional information such as XY coordinates for an animal moving in a tank or it can be used to plot data from an eye or head tracker.

This type of plot can also be used when the study subject needs to be in a specific position for accurate data acquisition. The XY plot can help the user to quickly determine if there were any significant changes in the subject's position such as the head position relative to the position of a sound or visual stimulus.

To quickly create an XY plot for a single channel of the selected data:

1. Drag a data event from the **Tank Select** window to the grid area.

The Select Plot Type box opens.



2. Click XY

The XY plot is added to the grid area and the Setup Properties dialog box opens with the most commonly used settings for the feature plot displayed.

Se	etup Properties for XY Pla	t	×
	Parameter Group	Common	•
	Source Name Y-Axis	????	
	Source Channel	0	-
	Source Name X-Axis	????	
	Cloud Points	1000	÷
	Multi View Enabled		
	Num Views	16	+
	Num Columns	4	
	Category Coloring	None	-
	Cancel	OK	

- 3. Related settings are grouped together by color. Other settings are available by clicking the **Parameter Group** box and selecting a **settings group**.
- 4. In the **Source Channel** box, enter the desired channel number.

- 5. Click the **Source Name X-Axis** box to select the desired data event for the X-axis. An event selection box opens.
- 6. Click the desired data event to select it, and click OK.
- 7. In the **Cloud Points** box, enter the minimum number of points to be displayed. The plot will refresh when the plot reaches twice the value set.
- 8. Click OK

The XY plot is configured for viewing a single channel of data. The plot can be positioned and resized using the mouse.

After a single channel XY plot has been created, the settings can be quickly modified for multichannel viewing.

To modify a XY plot to view multiple channels of data:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. In the **Source Channel** box, enter **0** to ensure that all channels are available for viewing.
- 3. Select the Multi View Enabled check box.
- 4. In the Num Views box, enter the total number of channels of data to be viewed.
- 5. By default channels will be displayed beginning with channel 1.To display multiple channels beginning with another channel, modify the index offset.
- 6. To modify the index offset value, click the Parameter Group value box, and click Multi View.
- 7. In the **View Index Offset** box, enter the number of channels to offset.
- 8. For example, to begin viewing from channel 5, enter an Index Offset value of 4. The plot will begin with channel 5 and display the next sequential channels to equal the number entered in the Num Views box.
- 9. Click OK

Creating Feature Plots

Feature plots compare two waveform properties, such as the first and second peak voltages of two candidate spikes. They are ideal for determining how many unique waveforms are present in a signal.

In OpenScope the feature plot has been designed for examining patterns of spike waveforms. The plot works best when viewing time stamped waveforms that are not continuous. In OpenEx this type of data is also called snippet data. Although other waveforms can be viewed, plotting complex waveforms with many points will require intensive amounts of computer time.

While the default feature of the Y-axis is the voltage of the second peak and the X-axis is the voltage of the first peak, the X-axis and Y-axis features can be selected from a drop down list in the Setup Properties dialog box. By generating multiple feature plots, each with different XY characteristics, it is possible to differentiate several spike types. This information can then be used to do offline or online spike sorting.

To quickly create a feature plot for a single channel of the selected data:

1. Drag a data event from the Tank Select window to the grid area.

The Select Plot Type box opens.



2 Click Feature

The feature plot is added to the grid area and the Setup Properties dialog box opens with the most commonly used settings for the feature plot displayed.

5 6	etup Properties for Feal	ure Plot	×
E	Parameter Group	Common	•
	Source Name	????	
	Source Channel	0	-
	Cloud Points	1000	
	X-Axis Feature	Peak 1	-
	Y-Axis Feature	Peak 2	•
	Multi View Enabled		
	Num Views	16	+
	Num Columns	4	+
	Category Coloring	By SortCode	•
	Cancel	OK	

- 3. Related settings are grouped together by color. Other settings are available by clicking the **Parameter Group** box and selecting a settings group.
- 4. In the **Source Channel** box, enter the desired channel number.
- 5. In the **Cloud Points** box, enter the minimum number of points to be displayed. The plot will refresh when the plot reaches twice the value set.
- 6. If desired, select an X-axis and/or Y-axis feature from the drop down menus in the corresponding value box. Select from Total Amplitude, Peak 1, Peak 2, Peak to Peak Time, or Area.
- 7. By default, Category Coloring is set to By SortCode and a different color will automatically be assigned to each sort code. When data is not associated with a sort code it will be assigned a gray color. If sort codes are not present in the data, change this setting to None to display data points in a brighter color for easier viewing.
- 8. Click OK

The feature plot is configured for viewing a single channel of data. The plot can be positioned and resized using the mouse.

After a single channel feature plot has been created, the settings can be quickly modified for multi-channel viewing.

To modify a feature plot to view multiple channels of data:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. In the **Source Channel** box, enter **0** to ensure that all channels are available for viewing.
- 3. Select the Multi View Enabled check box.
- 4. In the **Num Views** box, enter the total number of views required to see all available channels of data in the multi view. This number will typically be the number of channels of data acquired. By default channels will be displayed beginning with channel 1.
- 5. In the **Num Columns** box, enter the number of columns to display.
- 6. By default, Category Coloring is set to By SortCode and a different color will automatically be assigned to each sort code. When data is not associated with a sort code it will be assigned a gray color. If sort codes are not present in the data, change this setting to By Channel to display data points in brighter colors for easier viewing.
- 7. Click OK

After a multi-channel feature plot has been created, the settings can be quickly modified for viewing a range of channels.

To modify a scroll plot to view a range of channels:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. In the **Num Views** box, enter the total number of channels of data to be viewed. By default channels will be displayed beginning with channel 1.To display multiple channels beginning with another channel, modify the index offset.
- 3. To modify the index offset value, click the Parameter Group value box, and click Multi View.
- 4. In the **View Index Offset** box, enter the number of channels to offset.



For example, to begin viewing from channel 5, enter an Index Offset value of 4. The plot will begin with channel 5 and display the next sequential channels to equal the number entered in the Num Views box.

5. Click OK

Creating Chart Plots

Chart plots are an excellent way of graphing time stamped waveform data such as spike snippets. Unlike raster plots that only show the position of the time stamp over a narrow range in the block, the chart plot shows the snippet waveform and its exact position in the block of data.

In a chart plot the Y-axis is voltage and the X-axis is time in seconds. When the scale of the Xaxis is contracted the position of a snippet along the X-axis clearly identifies when in time the snippets occurred and patterns of occurrence over time are emphasized. As the scale of the Xaxis is expanded the shape of the waveform becomes more visible.

To quickly create a chart plot for single channel of the selected data:

1. Drag a data event from the Tank Select window to the grid area.

The Select Plot Type box opens.



2 Click Chart

The chart plot is added to the grid area and the Setup Properties dialog box opens with the most commonly used settings for the chart plot displayed.

5	etup Properties for Cha	rt Plot	×
	Parameter Group	Common	•
	Source Name	????	
	Source Channel	0	-
	Time Span	5	
	Multi View Enabled		
	Num Views	16	÷
	Num Columns	4	•
	Category Coloring	By Channel	•
	Cancel	OK	

- 3. Related settings are grouped together by color. Other settings are available by clicking the **Parameter Group** box and selecting a **settings group**.
- 4. In the Source Channel box, enter the desired channel number.
- 5. Enter the desired **Time Span** in seconds, to be displayed on the X-axis.
- 6. Click OK

The chart plot is configured for viewing a single channel. The plot can be positioned and resized using the mouse. When you animate or track data the plot will look like this:



To quickly expand the X-axis scale and view a snippet waveform, hold down the SHIFT key, point to the snippet, and drag to the right.

After a single channel chart plot has been created, the settings can be quickly modified for multi-channel viewing.

To modify a chart plot to view multiple channels of data:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. In the **Source Channel** box, enter **0** to ensure that all channels are available for viewing.
- 3. Enter the desired **Time Span** in second, to be displayed on the X-axis. Selecting a shorter time span will improve animation performance for multiple channels. When viewing the chart, the time span can be shortened or expanded by pressing and holding the SHIFT key, and dragging right or left with the mouse.
- 4. Select the Multi View Enabled check box.
- 5. In the **Num Views** box, enter the total number of views required to see all available channels of data in the multi view. This number will typically be the number of channels of data acquired. By default channels will be displayed beginning with channel 1.
- 6. In the **Num Columns** box, enter the number of columns to display. Leave this value set to 1 to see one channel per row.
- 7. Click OK

When you animate or track data the plot will look like similar to this:



After a multi-channel chart plot has been created, the settings can be quickly modified for viewing a range of channels.

To modify a chart plot to view a range of channels:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. In the Num Views box, enter the total number of channels of data to be viewed.
- 3. By default channels will be displayed beginning with channel 1. To displa multiple channels beginning with another channel, modify the index offset. To modify the index offset value, click the **Parameter Group** box, and click **Multi View**.

- 4. In the **View Index Offset** box, enter the number of channels to offset. For example, to begin viewing from channel 5, enter an Index Offset value of 4. The plot will begin with channel 5 and display the next sequential channels to equal the number entered in the Num Views box.
- 5. Click OK

Creating Activity Plots

Activity plots are used to view the amount of spike (or other) activity occurring on a given channel or group of channels. Activity plots make it easy to view spike counts or to compare spike rates between acquisition channels. Activity plots use time stamped values from a variety of data Stores for graphic presentation. The most common of these are snippets, but lists and even buffers can be included as long as a time stamp is part of the acquired value. Users define the minimum and maximum value to be displayed, assign a color to minimum and maximum, and choose a parameter for refreshing the plot. As the plot is animated the color of an activity cell varies in intensity across a range corresponding to the minimum and maximum defined values.

To quickly create an activity plot for combined data for all channels of the selected data:

1. Drag a data event from the Tank Select window to the grid area.



The Select Plot Type box opens.

2 Click Activity

The activity plot is added to the grid area and the Setup Properties dialog box opens with the most commonly used settings for the activity plot displayed.

50	etup Properties for Unkn	own	×
	Parameter Group	Common	•
	Source Name	Snip	
	Color at Min	0	
	Color at Max	FF	
	Min Value	0	+
	Max Value	200	÷
	Multi View Enabled		
	Num Views	1	
	Num Columns	1	
	Refresh Epoc Name		
	Cancel	OK	

- 3. Related settings are grouped together by color. Other settings are available by clicking the **Parameter Group** box and selecting a settings group.
- 4. In the **Refresh Epoch Name** box, select an epoch, or indexed, event. This must be selected to update the plot.
- 5. In the **Max Value** box enter a number at least as large as the maximum activity (number of spikes) anticipated.

6. Click OK

The Activity plot is configured for viewing combined data for all channels. The plot can be positioned and resized using the mouse. When you animate or track data the plot will look similar to this:



Combined Data Activity Plot with Activity Near Minimum Value



Combined Data Activity Plot with Activity Near Maximum Value

After a combined data activity plot has been created, the settings can be quickly modified for multi-channel viewing.

To modify an activity plot to view multiple channels of data:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. Select the Multi View Enabled check box.
- 3. In the **Num Views** box, enter the total number of views required to see all available channels of data in the multi view. This number will typically be the number of channels of data acquired. By default channels will be displayed beginning with channel 1.
- 4. In the **Num Columns** box, enter the number of columns to display. Depending on the design of your experiment you might want to view a pattern that is representative of the physical or logical distribution of the channels. For example, if you had electrodes placed in a 4 x 4 grid around the head then it would be useful to see that pattern in OpenScope. Similarly, if you had electrodes in a linear pattern you might want to have either 1 column or 16 columns.
- 5. Click OK

When you animate or track data the plot will look similar to this:



After a multi-channel activity plot has been created, settings can be modified to view by sort code.

To modify a multi-channel activity plot to view by sort code:

- 1. Double-click the plot to display the Setup Properties dialog box.
- 2. Click the Parameter Group box, and click Multi View.
- 3. In the View By box, select Sort Code from the drop down list.
- 4. Update the Num Views and View Index Offset values as needed.
- 5. Click OK

Plot Settings

Plots can be modified using the Setup Properties dialog box. When plots are grouped, setting changes can be made to all plots in the group.

Plot settings are grouped into parameter groups. The available settings are similar for each plot type. Settings unique to a plot type can generally be found under the Common and Behavior parameter groups.

CommonThe most commonly changed settings for the selected plot type. Related settings are grouped by color. The settings found in this group can also be found in the other parameter groups. There is a Common parameter group for each plot type: pile, scroll, histogram, raster, XY, feature, chart, and activityData SourceSettings to identify the data source as well as to control source channel, sorting code, and the data source definition. Additional settings to identify a second data source are available in the XY
Plot Data Source group
Multi View Settings to enable and control display of multi-channel viewing. When multi view is not enabled plots show results from a single channel, or sort, or all channels, or sorts, displayed together
Behavior Settings unique to the plot type
Pile Pile depth
Scroll How many sections will be displayed before scrolling
Histogram The event used for time, time values for refreshing, time span, and bin width
Raster The event used for time, time values for refreshing, and time span
XY Plot Time span to be displayed on the x-axis
Feature The minimum number of cloud points to be displayed
Chart Time span to be displayed on the x-axis
Activity Minimum and maximum values and corresponding color selections
Refresh Control Settings to control how and when the plot is refreshed
Scaling Settings to control plot scaling including the Auto Scale feature. Auto Scale can be disabled (None), set to scale at all times to ensure all values can be shown on the plot (Active), or set to scale only during the first 3 seconds (Smart)
X-Axis Setup Settings to control labels, unit name, unit factor, and offset for the x-axis. The X-Axis Units Factor defines the scalar of the default number of points
Y-Axis Setup Settings to control labels, unit name, unit factor, and offset for the y-axis. The Y-Axis Units Factor defines the scalar of the default number of points
Appearance Settings to control the plot appearance, such as title, title position, font size, and multi-channel grid.When you title a plot, the Plot Auto Title check box must be cleared before the change can be applied
Margins Settings to control the plot margins
Colors Settings to control the color of chart elements. Category Coloring can be set to use the trace color to draw the plot (None), to automatically select the color for each channel (By Channel), or to automatically select the color for each sort code (By SortCode)
Filtering Settings to enable or disable an FIR filter algorithm and to set parameters for the filter

Plot Setting Parameter Groups

Plot Settings Reference

About the Plot Settings Reference

The Plot Settings Reference corresponds to a parameter group in the properties dialog box.

How To Find These Settings Settings in this reference are available in the properties dialog boxes. To open the properties dialog box for a plot, double-click the plot in the grid area of OpenScope.

Colors Parameter Group

Category Coloring: Set how the trace colors will be applied.

- None: The color set in the Trace Color value box will be applied to all traces.
- By Channel: The color of traces will be automatically assigned by channel.
- By Sortcode: The color of traces will be automatically assigned by sortcode.

Trace (or Dot) Color: Select the trace color from a color palette. This selected color is only used if Category Coloring is set to None.

Plot Border Color: Select the plot border color from a color palette.

Foreground Color: Select the foreground color from a color palette.

Background Color: Select the trace color from a color palette.

Font Color: Select the font color from a color palette.

MultiChannel Grid Color: Select the multi-channel grid color from a color palette.

Filtering Parameter Group

Filter On: Select the check box to enable an FIR filter algorithm using FIR parameters provided in CoefB0-B4. Clear the check box to disable the filter.

CoefB0 - 4: Type a coefficient.

Multi View Parameter Group

Multi-View Enabled: Select the check box to view each channel, or sort code, of data in an individual plot.

Num Views: Set the number of channels or sorts to view in a multi-view plot. If data contains more than 16 channels or sorts the value must be increased to show all data.

Num Columns: Set the number of columns in which multi-view plots are arranged.

View By: Channel or Sort. Sorts are generated in the RPvdsEx circuit.

View Index Offset: Starting channel or sort is the View Index Offset value +1.

For example: To begin viewing data with channel 3, set the View Index Offset value at 2.

Show View Index: Index is Channel or Sort Code and is determined by the View By value.

Refresh Control Parameter Group

Refresh Epoch Name: Define the refresh epoch, or indexed event. Click the value box to view a list of events. Valid choices are preceded by an *F* epoch event icon. When a refresh epoch event is defined the plot will be refreshed based on the epoch value according to the settings in the Refresh Control parameter group.

Strobe Epoch Low Range: Set the low value for a range in which the plot will be refreshed according to the defined refresh epoch. Leave at the default value of 0 if a range will not be used.

If the scalar value read from the tank for the defined refresh epoch event is greater than the Strobe Epoch Low Range value then the plot is refreshed. If not, new data is added along with older data.

Strobe Epoch High Range: Set the high value for a range in which the plot will be refreshed according to the defined refresh epoch. Leave at the default value of -1 if a range will not be used.

If the scalar value read from the tank for the defined refresh epoch event is less than the Strobe Epoch High Range value then the plot is refreshed. If not, new data is added along with older data.

Refresh on Change: Select the check box to refresh the plot when the scalar value associated with the defined refresh epoch changes.

This setting can be used with the range settings to create a range in which the plot will be refreshed on change.

Refresh Period: Set a time value for the refresh period in seconds.

Scaling Parameter Group

X / Y-Axis Range: Type a value to set the range for the X / Y - axis.

X / Y-Axis Symmetry: Select the check box to ensure that a symmetrical X/Y-axis range will be displayed. This is ideal for signals that are expected to be symmetrical.

Auto Scale: The plot can be set to automatically scale during animation to ensure that the data can always be viewed in a convenient scale.

- None: Auto Scale is turned off.
- Active: The scale of the plot is automatically adjusted to ensure all values can be shown on the plot.
- Smart: The scale of the plot is automatically adjusted to ensure values can be shown on the plot only during the first 3 seconds.

Up-Scale Hist.: When Auto Scale is used, this value sets the number of points above the Y-axis range that the signal must reach before scaling will occur.

Down-Scale Hist.: When Auto Scale is used, this value sets the number of points below half of the Y-axis range a signal must fall before scaling will occur.

X-Axis Setup Parameter Group

Show X Labels: Select the check box to display a unit label for the x-axis. Clear the check box to hide the x-axis label.

X-Axis Unit: Set name for units that will appear as part of the plot label.

X-Axis Units Factor: Define a multiplication factor to convert x-axis units to valid value for the units label.

X-Axis Offset: Define the starting value for the x-axis.

Y-Axis Setup Parameter Group

Show Y Labels: Select the check box to display a unit label for the y-axis. Clear the heck box to hide the y-axis label.

Y-Axis Units: Set name for units that will appear as part of the plot label.

Y-Axis Units Factor: Define a multiplication factor to convert y-axis units to valid value for the units label.

Behavior Parameter Group

Activity Behavior Parameters

Color at Min: Select the color to be displayed when activity is at defined Min Value. Color for values between Min and Max Values are generated using a proportional mix of the defined Colors at Min and Max.

Color at Max: Select the color to be displayed when activity is at defined Min Value. Color for values between Min and Max Values are generated using a proportional mix of the defined Colors at Min and Max.

Min Value: Enter the number of spike to be defined as the minimum value, which is represented by the defined Color at Min.

Max Value: Enter the number of spike to be defined as the maximum value, which is represented by the defined Color at Max.

Show Num Trace: Select the check box to display the number of events in the activity cell. Clear the check box to hide the number label.

Chart Behavior Parameters

Time Span: Set the time range, in seconds and according to the time stamp, to be displayed on the X-axis.

Feature Behavior Parameters

Cloud Points: Set the minimum number of points to display. The maximum number of cloud points will be twice the value set. The plot will refresh when the maximum number is reached.

X-Axis Feature: Select from a drop down list. Choices are Peak 1, Peak 2, Peak to Peak Time, and Area.

Y-Axis Feature: Select from a drop down list. Choices are Peak 1, Peak 2, Peak to Peak Time, and Area.

Histogram Behavior Parameters

TimeRef Epoch Name: Defines the epoch, or indexed event, that will be used for the raster rows. Click the value box to view a list of events. Valid choices are preceded by an *F* epoch event icon.

Respect TRef Duration: When checked the plot's X-axis scale is equal to the duration of the epoch event selected in the TimeRef Epoch Name setting.

TRef Epoch Low Range: Use to set the low value for the X-axis range according to the defined TimeRef epoch event. As data is animated, the next data will only be displayed if the associated epoch event value is greater than or equal to the low range value. Leave at default value of 0 if a range will not be used.

TRef Epoch High Range: Use to set the high value for the X-axis range according to the defined TimeRef epoch event. As data is animated, the next data will only be displayed if the associated epoch event value is less than or equal to the high range value. Leave at default value of -1 if a range will not be used.

Time Span: Define the time span if the Respect TRef Duration check box is cleared. The X-axis will be equal to the value set for Time Span divided by the value set for Bin Width.

Bin Width: Define the Bin Width. The X-axis will be equal to the value set for Time Span divided by the value set for Bin Width.

Pile Behavior Parameters

Pile Depth: Set the minimum number of traces that will be displayed. The maximum number of traces will be twice the value set. The plot will refresh when the maximum number is reached.

Raster Behavior Parameters

Raster Rows: Select the number of rows to display.

TimeRef Epoch Name: Defines the epoch, or indexed event, that will be used for the raster rows. Click the value box to view a list of events. Valid choices are preceded by an *F* epoch event icon.

Respect TRef Duration: When checked the plot's X-axis scale is equal to the duration of the epoch event selected in the TimeRef Epoch Name setting.

TRef Epoch Low Range: Use to set the low value for the X-axis range according to the defined TimeRef epoch event. As data is animated, the next data will only be displayed if the associated epoch event value is greater than the low range value. Leave at default value of 0 if a range will not be used.

TRef Epoch High Range: Use to set the high value for the X-axis range according to the defined TimeRef epoch event. As data is animated, the next data will only be displayed if the associated epoch event value is less than the high range value. Leave at default value of -1 if a range will not be used.

Time Span: Define the maximum value of the X-axis using a time stamp value if the Respect TRef Duration check box is cleared.

Scroll Behavior Parameters

Scroll Sections: Set the number of sections to display before scrolling.

XY Behavior Parameters

Cloud Points: Set the minimum number of points to display. The maximum number of cloud points will be twice the value set. The plot will refresh when the maximum number is reached.

Common Parameter Group

Activity Common Parameters

Source Name: Select the data event (Store name) from the currently selected tank.

Color at Min: Select the color to be displayed when activity is at defined Min Value. Color for values between Min and Max Values are generated using a proportional mix of the defined Colors at Min and Max.

Color at Max: Select the color to be displayed when activity is at defined Min Value. Color for values between Min and Max Values are generated using a proportional mix of the defined Colors at Min and Max.

Min Value: Enter the number of spike to be defined as the minimum value, which is represented by the defined Color at Min.

Max Value: Enter the number of spike to be defined as the maximum value, which is represented by the defined Color at Max.

Multi View Enabled: Enables multi view for viewing multiple channels. When multi view is enabled, Source Channel should be set to 0.

Num Views: Select the number of channels or sort codes to view. By default, channels will be displayed beginning with channel 1.

Num Columns: Select the number of columns to display.

Refresh Epoch Name: Define the refresh epoch, or indexed event. Click the value box to view a list of events. Valid choices are preceded by an *F* epoch event icon. When a refresh epoch event is defined the plot will be refreshed based on the epoch value according to the settings in the Refresh Control parameter group.

Chart Common Parameters

Source Name: Select the data event (Store name) from the currently selected tank.

Source Channel: Selects the channel for viewing. To view a single channel of data enter the desired channel number. To view multiple channels set to 0 and enable multi view.

Time Span: Set the time range, in seconds and according to the time stamp, to be displayed on the X-axis.

Multi View Enabled: Enables multi view for viewing multiple channels. When multi view is enabled, Source Channel should be set to 0.

Num Views: Select the number of channels or sort codes to view. By default, channels will be displayed beginning with channel 1.

Num Columns: Select the number of columns to display.

Category Coloring: Selects the trace coloring method. Traces can be seen in a single color (None), one color per channel (By Channel), or one color per sort code (By SortCode).

Feature Common Parameters

Source Name: Select the data event (Store name) from the currently selected tank.

Source Channel: Selects the channel for viewing. To view a single channel of data enter the desired channel number. To view multiple channels set to 0 and enable multi view.

Cloud Points: Set the minimum number of points to display. The maximum number of cloud points will be twice the value set. The plot will refresh when the maximum number is reached.

X-Axis Feature: Select from a drop down list. Choices are Peak 1, Peak 2, Peak to Peak Time, and Area.

Y-Axis Feature: Select from a drop down list. Choices are Peak 1, Peak 2, Peak to Peak Time, and Area.

Multi View Enabled: Enables multi view for viewing multiple channels. When multi view is enabled, Source Channel should be set to 0.

Num Views: Select the number of channels or sort codes to view. By default, channels will be displayed beginning with channel 1.

Num Columns: Select the number of columns to display.

Category Coloring: Selects the trace coloring method. Traces can be seen in a single color (None), one color per channel (By Channel), or one color per sort code (By SortCode).

Histogram Common Parameters

Source Name: Select the data event (Store name) from the currently selected tank.

Source Channel: Selects the channel for viewing. To view a single channel of data enter the desired channel number. To view multiple channels set to 0 and enable multi view.

TimeRef Epoc Name: Define the epoch, or indexed event, that will be used for the vertical bars. Click the value box to view a list of events. Valid choices are preceded by an **F** strobe/indexed event icon.

Time Span: Define the time span. The X-axis will be equal to the value set for Time Span divided by the value set for Bin Width.

Bin Width: Define the Bin Width. The X-axis will be equal to the value set for Time Span divided by the value set for Bin Width.

Multi View Enabled: Enables multi view for viewing multiple channels. When multi view is enabled, Source Channel should be set to 0.

Num Views: Select the number of channels or sort codes to view. By default, channels will be displayed beginning with channel 1.

Num Columns: Select the number of columns to display.

Category Coloring: Selects the trace coloring method. Traces can be seen in a single color (None), one color per channel (By Channel), or one color per sort code (By SortCode).

Pile Common Parameters

Source Name: Select the data event (Store name) from the currently selected tank.

Source Channel: Selects the channel for viewing. To view a single channel of data enter the desired channel number. To view multiple channels set to 0 and enable multi view.

Pile Depth: Set the minimum number of traces that will be displayed. The maximum number of traces will be twice the value set. The plot will refresh when the maximum number is reached.

Multi View Enabled: Enables multi view for viewing multiple channels. When multi view is enabled, Source Channel should be set to 0.

Num Views: Select the number of channels or sort codes to view. By default, channels ill be displayed beginning with channel 1.

Num Columns: Select the number of columns to display.

Category Coloring: Selects the trace coloring method. Traces can be seen in a single color (None), one color per channel (By Channel), or one color per sort code (By SortCode).

Raster Common Parameters

Source Name: Select the data event (Store name) from the currently selected tank.

Source Channel: Selects the channel for viewing. To view a single channel of data enter the desired channel number. To view multiple channels set to 0 and enable multi view.

Raster Rows: Select the number of rows to display.

TimeRef Epoc Name: Defines the epoch, or indexed event, that will be used for the raster rows. Click the value box to view a list of events. Valid choices are preceded by an **F** strobe/indexed event icon.

Time Span: Define the maximum value of the X-axis using a time stamp value.

Multi View Enabled: Enables multi view for viewing multiple channels. When multi view is enabled, Source Channel should be set to 0.

Num Views: Select the number of channels or sort codes to view. By default, channels will be displayed beginning with channel 1.

Num Columns: Select the number of columns to display.

Category Coloring: Selects the trace coloring method. Traces can be seen in a single color (None), one color per channel (By Channel), or one color per sort code (By SortCode).

Scroll Common Parameters

Source Name: Select the data event (Store name) from the currently selected tank.

Source Channel: Selects the channel for viewing. To view a single channel of data enter the desired channel number. To view multiple channels set to 0 and enable multi view.

Scroll Sections: Selects the number of scroll sections to display.

Multi View Enabled: Enables multi-view for viewing multiple channels. When Multi View is enabled, Source Channel should be set to 0.

Num Views: Select the number of channels or sort codes to view. By default channels will be displayed beginning with channel 1.

Num Columns: Select the number of columns to display. Leave this value set to 1 to see one channel per row.

Confine Plotting Data In Cell Boundary: When the checkbox is selected, plot data will not cross its cell boundaries. When disabled, plot data can exceed the boundary.

Plotting Margin Percentage: Select a value to increase or decrease the margin percentage for displaying data while multi view is enabled.

XY Common Parameters

Source Name Y-Axis: Define the Event ID (Store name) for the Y-Axis of the plot. Click to display a list of available event IDs.

Source Channel: Set to 0 to display all channels. Set to a valid channel number to display a single channel of data.

Source Name X-Axis: Define the Event ID for the X-Axis of the plot. Click to display a list of available event IDs.

Cloud Points: Set the minimum number of cloud points to display. The maximum number of cloud points will be twice the value set. The plot will refresh when the maximum number is reached.

Multi View Enabled: Enables multi view for viewing multiple channels. When multi view is enabled, Source Channel should be set to 0.

Num Views: Select the number of channels or sort codes to view. By default, channels will be displayed beginning with channel 1.

Num Columns: Select the number of columns to display.

Category Coloring: Selects the trace coloring method. Traces can be seen in a single color (None), one color per channel (By Channel), or one color per sort code (By SortCode).

Data Source Parameter Group

Shared Data Source Parameters

Source Name: Define the Event ID (Store Name) for the plot. Click to display a list of available event IDs.

Source Channel: Set to 0 to display all channels. Set to a valid channel number to display a single channel of data.

Sorting Code: Set to 0 if a sort parameter has not been defined or will not be used. Set to a valid sort number to display a single sort.

Enabled: Clear the check box to disable the data definition for the plot.

XY Plot Data Source Parameters

Source Name Y-Axis: Define the Event ID (Store name) for the Y-Axis of the plot. Click to display a list of available event IDs.

Source Channel: Set to 0 to display all channels. Set to a valid channel number to display a single channel of data.

Sorting Code: Set to 0 if a sort parameter has not been defined or will not be used. Set to a valid sort number to display a single sort.

Source Name X-Axis: Define the Event ID (Store name) for the X-Axis of the plot. Click to display a list of available event IDs.

Enabled: Clear the check box to disable the data definition for the plot.