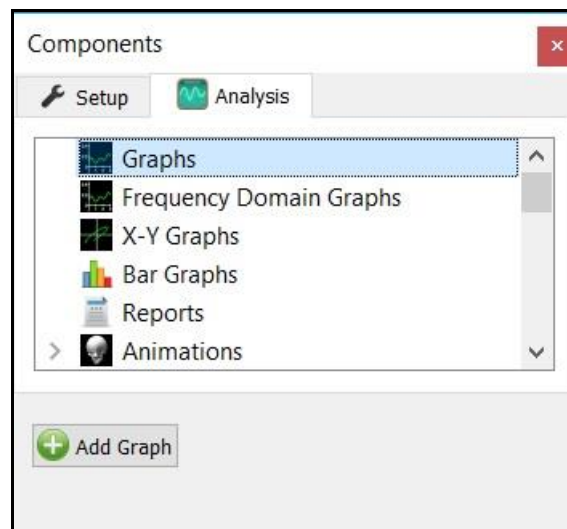


The MotionMonitor xGen Software Guide: **Adding Graphs** **(Time Series, Frequency Domain, X-Y and Bar Graphs)**

This document reviews the process for adding graphs through the Graphs, Frequency Domain Graphs, X-Y Graphs and Bar Graphs nodes in the Analysis Components window. Each of these graph nodes provides an intuitive way to quickly and easily present data. A tutorial video for adding graphs can be found on our website, <https://themotionmonitor.com/support/>. Data can also be displayed in the Animation window as text, traces or objects. For more information on presenting data in an Animation window, please refer to the tutorial video for adding Animations, <https://themotionmonitor.com/support/> or review our knowledge base article for 'Adding Objects to the Animation Window'.

Graphs can be added by right-clicking on one of the graph nodes in the Components Analysis tab and selecting the add graph option or by clicking on the Add Graph button in the parameters panel when a Graph node is highlighted. Graphs and Bar Graphs can also be added by right clicking on a Permanent, Analysis, Permanent Script or Analysis Script variable and selecting the Graph or Bar Graph option. Boolean, Integer and Scalar data types can all be displayed within graphs. Boolean data are displayed as 1 when TRUE or 0 when FALSE.



Once any of these Graph types have been added individual plots can be added by right clicking on the graph and selecting the add option or clicking on the Add plot button within the parameters panel for the graph.

Any graph can be duplicated by right clicking on the graph and selecting the copy option and then right clicking under the same type of Graph node again and selecting paste. For instance, you could end up with two identical X-Y Graphs which would then allow you to make a few simple changes while keeping all of the other settings consistent. However, one could not copy an X-Y Graph and then paste it into the Bar Graphs node. Individual plots can also be copied and pasted between graphs of the same type.

When multiple plots exist within a graph their order can be rearranged within that graph by clicking on the plot under the graph node and dragging it to a different position within the same graph.

Graphs

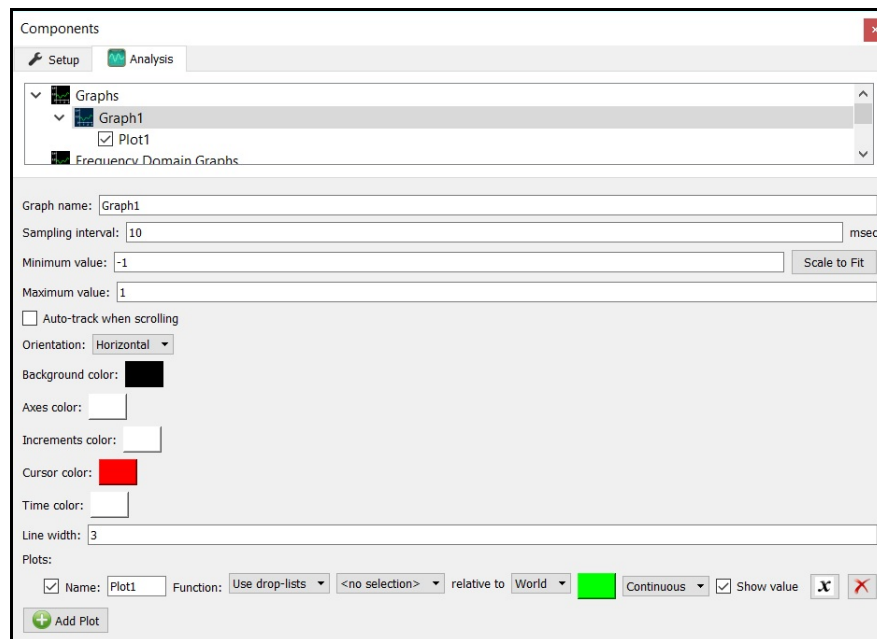
Graphs allow for data to be displayed against time. The amount of time that data are displayed for in the Live Window is determined by the Live Period specified in the Hardware parameters panel in the Components Setup tab or by the length of the recording for Activity data. The time scale for a graph, traditionally considered as the horizontal or x-axis, can be zoomed in or out by clicking on a graph and using the mouse scroll wheel. When enabled, the “Auto-track when scrolling” check box will cause any zoomed in time window to move with the cursor as it progresses through the activity during playback.

The “Graph name” is what gets displayed in the title bar for each graph. This name can also be used in customized scripts for showing and hiding graphs which can be tied to a Toolbar icon.

The “Sampling Interval” specifies the rate at which data are plotted in the graph. Data can be under or over sampled for display purposes and this has no impact on the underlying data being recorded. Over sampling or selecting the true sampling interval in some cases can result in reduced performance due to increased computer resources being required. The Sampling interval is specified in msec. Caution should be taken such that this interval is not under sampled to an extent such as to violate the Nyquist Theorem.

The “Minimum value” and “Maximum value” control the non-time series axis of the graph, traditionally considered as the vertical or y-axis. The “Scale to Fit” button automatically adjusts this axis to fit all of the data. For the Live Window, this is based on all of the data contained within the Live Period and is scaled across the entire recording for Activity data. This axis can also be zoomed in or out by left-clicking within a graph and using the mouse scroll wheel while still holding the left mouse button. When enabled, the “Auto-track when scrolling” check box will result in the data range being increased to ensure all plots can be seen as the cursor progresses through the activity during playback.

The “Orientation” drop list allows for the data to be displayed in a time series that scrolls horizontally (left to right) or vertically (bottom to top).



The “Background color” controls the color displayed in the background for the graph. In the example below, the background is set to black.

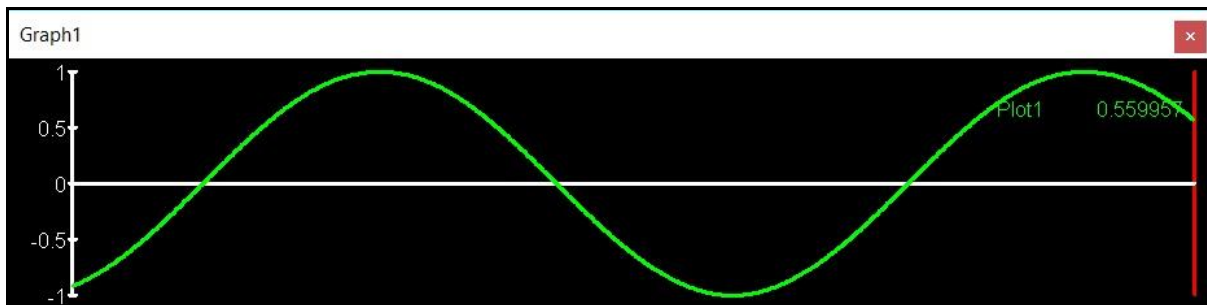
The “Axes color” refers to the color of the X and Y axis or horizontal and vertical axis lines. In the example below, the Axes are set to white.

The “Increments color” refers to the numbers displayed with the axes. In the example below, the Increments are set to white.

The “Cursor color” refers to the cursor that indicates the current frame of data. For the Live Window, this will always be on the right side of the graph, as this is where the current data are displayed from. For Activity data, the cursor will be displayed at the current frame being evaluated. In the example below, the Cursor is set to red.

The “Time color” refers to the current time value that gets displayed in the upper right hand legend in Activity data. The Time value is not displayed in the Live Window.

Any of these items can be hidden by specifying that they be the same color as the background.



The “Line Width” refers to the width of the lines for data Plots and Axes.

An individual plot can be displayed or hidden by enabling or disabling the plot’s checkbox, respectively. The “Name” for each plot will be displayed in the upper right hand corner of the graph, along with the current value of its data. The “Function” is where the plot is actually defined, either using the drop-lists or formula method. Each plot also has a color picker, where the color for the plot and its data within the legend is determined. In the example above, green was selected for the color of the plot. The display mode for the plot can also be selected as either Continuous or Discrete. When Continuous is selected, the plot will be displayed with no gaps, unless data are missing. When Discrete is selected, data will be displayed at the Sampling interval rate, when data are available. The “Show value” checkbox will display or hide the plot name and value for the plot in the legend of the graph. The Add Variable icon (⌘) adds the plot to the Analysis Variables node and the Delete icon (⌘) removes the plot from the graph.

Frequency Domain Graphs

Frequency Domain Graphs allow for data to be plotted in the Frequency domain. The parameters in the Frequency Domain Graphs are similar to Graphs settings, with a few significant differences.

First, it's important to note that frequency domain analyses and graphs can not be performed and therefore displayed in real time (i.e. the Live window). This type of graph can only be displayed within Activity data.

The “Start time” and “Stop time” checkboxes allow for the frequency domain calculations to be performed and evaluated over a specified subset of time for an activity. When disabled, the frequency domain analysis are performed for the selected data over the entire activity (from InitialTime to FinalTime).

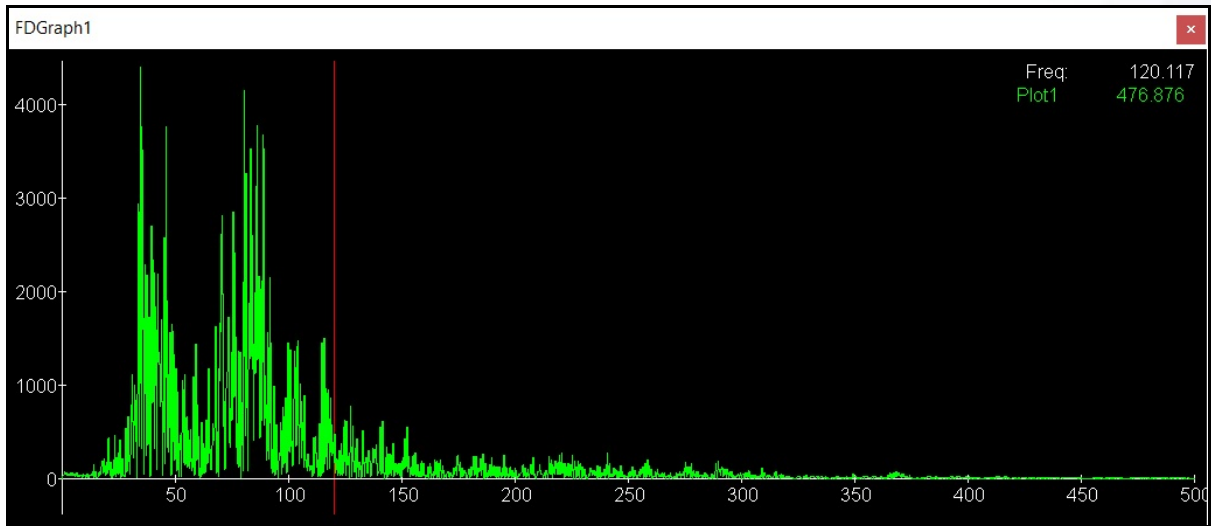
The “Sampling Interval” should typically be set to the raw data measurement rate (in msec) for the signal being evaluated. This will determine the range for the x or horizontal axis, which corresponds to the frequency. The highest value displayed on this axis will be the Nyquist frequency or half of the sampling frequency. For instance, if 10msec is specified for the “Sampling Interval” the maximum frequency display for the x-axis will be 50 Hz.

The “De-trend” check box for each plot will result in any trend or slope as well as any offset removed from the signal before performing the frequency analysis.

The screenshot shows the 'Components' window with the 'Analysis' tab selected. The tree view shows 'Graphs' expanded to 'Frequency Domain Graphs', which contains 'FDGraph1'. Under 'FDGraph1', 'Plot1' is checked. The configuration panel for 'FDGraph1' includes the following settings:

- Frequency domain graph name: FDGraph1
- Start time: Start time: Use formula InitialTime
- Stop time: Stop time: Use formula FinalTime
- Sampling interval: 10 msec
- Minimum value: -1 (Scale to Fit button)
- Maximum value: 1
- Orientation: Horizontal
- Background color: Black
- Axes color: White
- Increments color: White
- Cursor color: Red
- Time color: White
- Line width: 3
- Plots: Name: Plot1 Function: Use drop-lists <no selection> relative to World De-trend Continuous
- + Add Plot

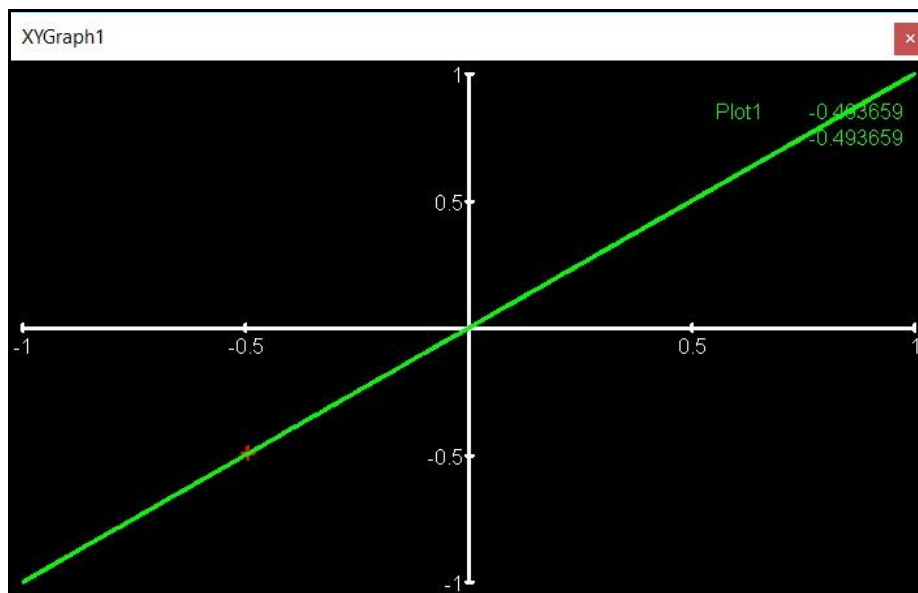
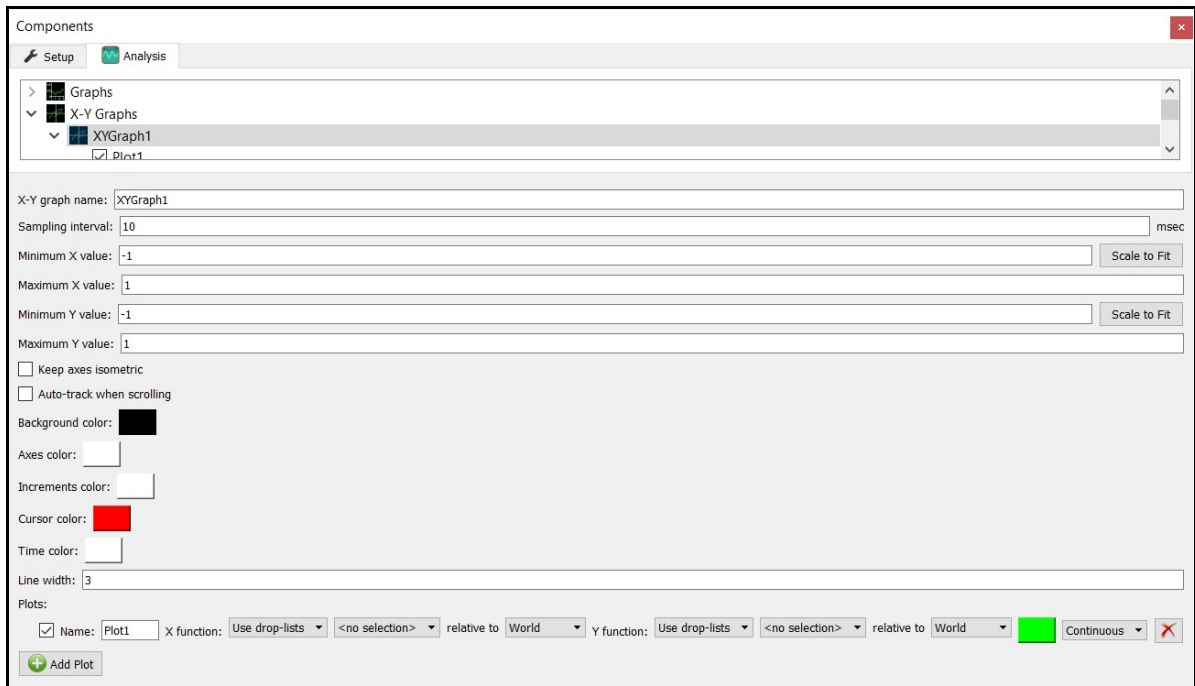
The cursor for the Frequency Domain graph is not tied to the activity playback slider. For Frequency Domain graphs, the cursor can be dragged to a point of interest where the Frequency and Power will be displayed in the graph legend.



X-Y Graphs

X-Y Graphs allow for one variable to be plotted against another. The parameters panel for X-Y Graphs also has many similar settings as the Graphs.

However, unique to X-Y graphs is that they have the option to “Keep axes isometric”, which scales both X and Y axes when updating any of the min or max values as well as adjusting the zoom directly through the X-Y graph.



Bar Graphs

Bar Graphs allow for variables to be displayed as bars. The parameters panel for Bar Graphs have many similar settings to the Graphs as well.

However, there are several unique attributes to the Bar Graph, including the “Bar width”, which controls the width for all plotted data.

Bar graphs can also either be plotted side-by-side or overlaid on one another when the “Allow overlay” check box is enabled. When “Allow overlay” is enabled, the bar plots will be stacked on top of one another, with bars listed first being stacked on the bottom. When “Allow overlay” is disabled, the bar plots will be displayed based on their “Position (integer)” values, which are explained in the following paragraphs. As discussed previously with Graphs, the order or plots can be manually changed if desired.

The “Show legend” check box will enable or disable the view of the bar names and current values displayed in the upper right hand corner as well as the Time data displayed with Activity data.

The screenshot shows the 'Components' panel in the MotionMonitor software. It features a tree view on the left with the following structure:

- Graphs
 - X-Y Graphs
 - Bar Graphs
 - BarGraph1
 - Bar1

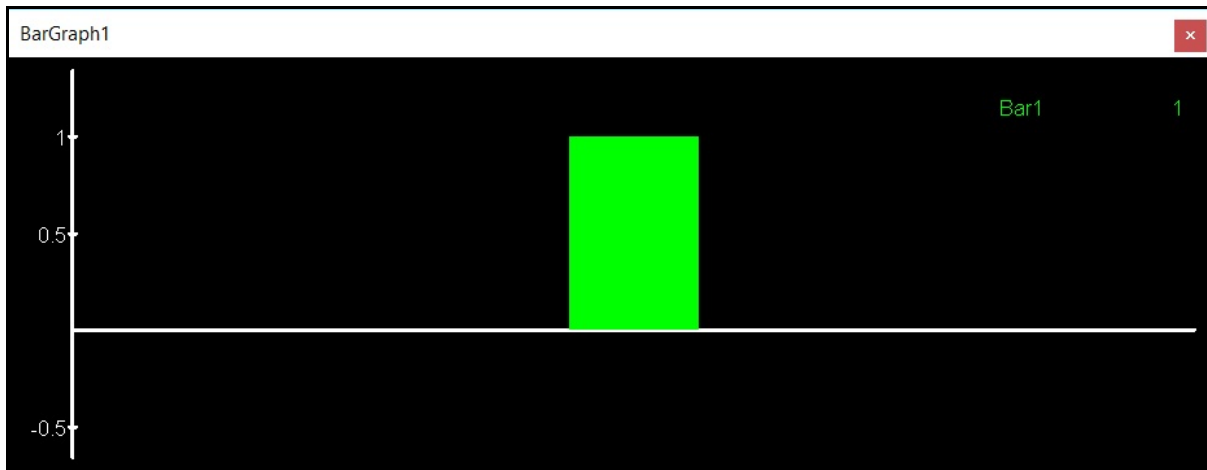
The configuration settings for the selected 'Bar1' component are as follows:

- Bar graph name: BarGraph1
- Minimum value: -1
- Maximum value: 1
- Orientation: Horizontal
- Background color: Black
- Axes color: [Color Picker]
- Increments color: [Color Picker]
- Time color: [Color Picker]
- Line width: 3
- Bar width: 20
- Allow overlay:
- Show legend:
- Bars:
 - Name: Bar1
 - Position (integer): 0
 - Function: Use drop-lists
 - <no selection>
 - relative to: World
 - Opacity (0-1): 1

An 'Add Bar' button is located at the bottom left of the configuration area.

For each bar plot the “Position (integer)” can be specified, which determines where the bar is placed. When a single bar plot exists within a graph, the bar will be centered in the graph. With multiple plots, the graph will automatically scale based on the “Position (integer)” values specified for any bar plots, including those that are hidden or disabled. A space will be displayed between any bar plots with different “Position (integer)” values. When bar plots are assigned the same “Position (integer)” value, they will either display side-by-side to one another or overlaid (if “Allow overlay” is enabled).

The “Opacity (0-1)” for each bar plot can also be selected. This is most applicable for when “Allow overlay” is enabled or to provide a slight visual differentiation between two plots.



Once configured, all of the graph settings can be saved or loaded through Workspace and Analysis files. More information for these topics can be found in the video tutorial for [Understanding Components and Analyses](#).

It is important to note that the more Animation windows and Graphs that are displayed and plots that are enabled, the more resources that will be required by the computer. So, it is recommended that these be kept to a minimum of what is necessary, especially within the Live Window. Analyses can be saved and loaded to control which Animations and Graphs are displayed.