Chapter J: The Force Plate Analysis Module

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Datapac 2K2 User's Manual, Ver 3

Chapter J: The Force Plate Analysis Module

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J-1. Introduction

The purpose of the Datapac 2K2 Force Plate Analysis module is to measure ground reaction forces recorded from a compatible force plate or pair of force plates161, to derive moments and center of pressure data, and to display and analyze them in various ways. Datapac 2K2 currently supports force plates from Kistler, Bertec, and AMTI.

To access the Force Plate Analysis module, select **Analysis|Force Plate** from the main window menu bar or the  icon from the main window tool bar. Either method opens the force plate control panel window. An example is shown in Figure J-1. The control panel is the main interface for all of the tasks incorporated into the Force Plate Analysis module. Its various buttons provide access to the module's various configuration, display and analysis features. Brief descriptions of each option are provided in Table J-1. Additional details are provided in Sections J-2 through J-8.

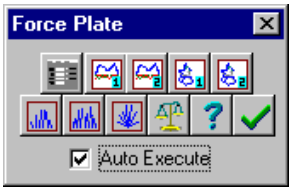


Figure J-1. The force plate control panel window.

Table J-1. Options in the Force Plate Control Panel Window.

Setup: Select this button to enter or adjust the calibration parameters required to correctly interpret the signals obtained from your force plate(s), to establish the units of force and displacement, and a few other important analysis setup parameters. Proper configuration is essential for accurate results. Additional details are provided in Section J-2.


Force Components Time Series Graphs 1 and 2: Select one of these buttons to plot force, moment, and/or center of pressure data with respect to time. Both buttons open the same kind of display window, and the two can be used interchangeably but formatted independently. Additional details are provided in Section J-3.


Force Components X-Y Graphs 1 and 2: Select one of these buttons to plot force, moment, and/or center of pressure signals with respect to each other. Although XY graphs can be used to plot force and moment data just as easily, they are perhaps most commonly used to plot center of pressure data computed for the the X versus Y dimensions over the course of a trial. Both buttons open the same kind of display window, and the two can be used interchangeably but formatted independently. Additional details are provided in Section J-4.

Vector Position Graph: Select this button to view force data as vectors with respect to force plate position. Three viewing orientations are possible: frontal, sagittal, and transverse. Additional details are provided in Section J-5.

Vector Time Graph: Select this button to view force data as vectors over the duration of a trial, a portion of a trial, or over several trials. Three viewing orientations are possible: frontal, sagittal, and transverse. Additional details are provided in Section J-6.

Vector Point Graph: Select this button to view force data as vectors arising from a single point in space. Three viewing orientations are possible: frontal, sagittal, and transverse. Additional details are provided in Section J-7.

Stability Analysis: Select this button to perform a stability analysis on your data. A stability analysis analyzes the variations in center of pressure over the course of the entire file, or one or more selected segments of the file. Additional details are provided in Section J-8.

Auto Execute: If this checkbox is checked when the force plate analysis module is closed, then the next time it is opened all of the displays that were in effect when the module was closed will automatically reopen in their original locations.

J-2. Configuring the Force Plate Analysis Module

Before you can obtain accurate results it is essential to correctly configure the force plate analysis module for your particular force plate(s). This involves selecting a few general analysis parameters that the module will use to process and report your data as well as selecting the proper type of force plates and entering the proper configuration parameters for them.

All of the module's configuration parameters are contained within the **Force Plate Setup window**. An example is shown in Figure J-2. To access the window, click on the  button in the module's control panel. As Figure J-2 illustrates, the Force Plate Setup window contains four tabbed sections: **Analysis**, **AMTI**, **Bertec**, and **Kistler**. The **Analysis** tab contains a set of general parameters that apply regardless of the type of force plate(s) you have. Be sure to select the correct force plate manufacturer and the numver of plates in use here. Details are provided in Section J-2.1. The **AMTI**, **Bertec**, and **Kistler** tabs are then used to establish the configuration parameters for the particular type of force plate you are using. If you are using two plates, both must be from the same manufacturer. Details are provided in Sections J-2.2 through J-2.4.

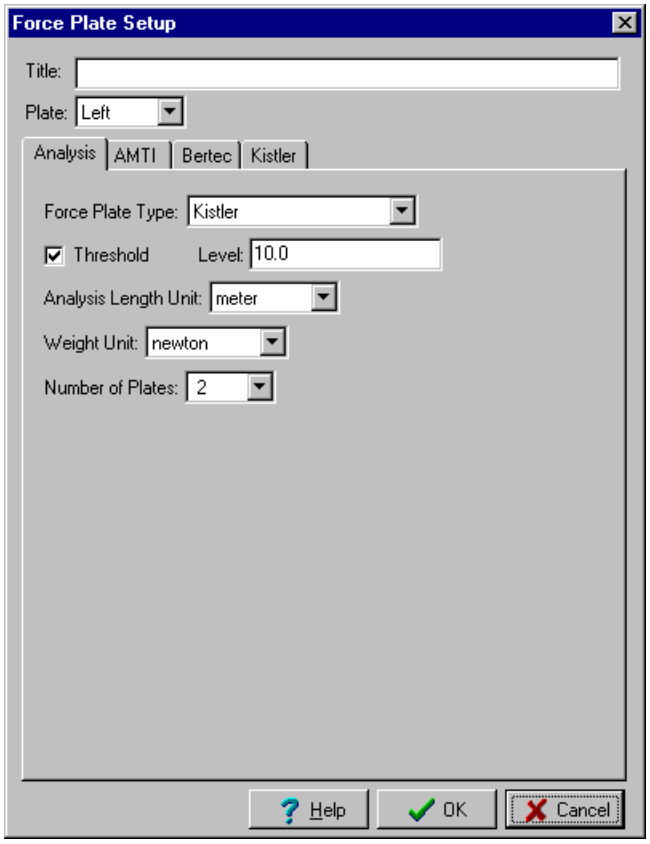


Figure J-2. The force plate module's Setup window.

J-2.1. General Force Plate Analysis Parameters

The Analysis tab of the Force Plate Setup Window provides access to a small set of parameters that affect the way force plate data are handled and displayed. The Analysis tab is show in Figure J-2 in the previous section. The operation of each option in the tab is described in the following paragraphs.

Force Plate Type: Select the manufacturer of your force plate(s) here. The configuration parameters that you establish for the plate(s) in the AMTI, Bertec, or Kistler tabs do not take effect unless the corresponding manufacturer is selected here.

Threshold, Level: It is often preferable to exclude portions of the force plate data from displays or results tables when the amplitude of the force in the Z dimension (i.e., into the ground) is low. For example, when no force is applied to the force plate, the calculated center of pressure is dramatically affected by minor noise variations in the system. It is therefore misleading to include such intervals in displays or analyses. That is the purpose of the Threshold and Level options. The **Threshold** checkbox enables (when checked) or disables (when cleared) the threshold level feature. When the feature is enabled data are analyzed and displayed only when the force in the Z dimension exceeds the value specified in the **Level** box. In contrast, when the feature is disabled, data are analyzed and displayed regardless of the force amplitude. The threshold level is expressed in whatever weight (force) units you select.

Analysis Length Unit: This option determines the unit of measure used to report displacement data throughout the Force Plate Analysis module. Three options are offered: meters, centimeters, or millimeters.

Weight Unit: This option determines the unit of measure used to report weigth, mass, or amplitude data throughout the Force Plate Analysis module. Three options are offered: Newtons, kilograms (kg), or pounds (lb).

Number of Plates: Select the number of force plates you are using here. If you select two plates, one is automatically labeled Left and the other Right. They are identified as such throughout the program.

J-2.2. Configuring an AMTI Force Plate

An example of the AMTI tab of the Force Plate Setup window is shown in Figure J-3. Details are provided in the remaining paragraphs of this section. It is important to recognize that the parameters that are reported at any one time are ther parameters associated with only one force plate. If you are using two force plates you need to establish the configuration parameters for each one of them. The plate for which the parameters correspond is indicated in the **Plate** box located in the Force Plate Setup window just above the tabs.

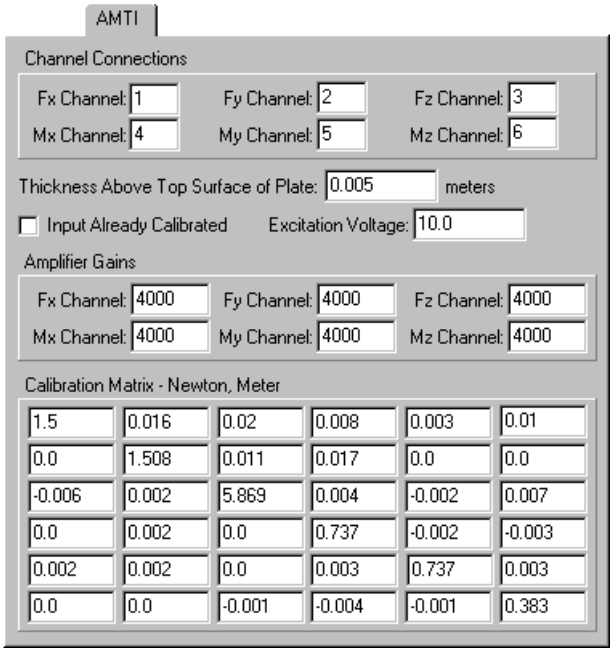


Figure J-3. An example ot the AMTI tab of the Force Plate Setup window.

Channel Connections: AMTI force plates produce six analog output signals. Identify the input channel of your acquisition system that was used to acquire each type of output in the eight boxes labeled **Fx Channel** through **Mz Channel**. For example, if the Fx output signal from the force plate was recorded on channel 1 of your acquisition system, then enter "**1**" in the box labeled **Fx Channel**.

Thickness Above Top Surface of Plate: The distance (in meters) between the actual surface of the plate and the working surface. For example, if you covered the surface of the plate with a plywood panel, enter the thickness of the panel here.

Input Already Calibrated: Check this check box if the force and moment data in the open data file have already been converted to force and moment units (as opposed to raw voltage). This is sometimes the case in data files that were not acquired within DATAPAC itself. For example, data files acquired with Peak Performance systems are almost always converted to force and moment units.

Excitation Voltage: Indicate your plate's excitation voltage as indicated in the documentation provided with your equipment.

Amplifier Gains: Each of the six analog output signals has a user-selectable gain value associated with it. Enter the gains you have selected for each channel in the six boxes provided in this section.

Calibration Matrix: Enter the values into this matrix exactly as they appear on the calibration sheet provided with your equipment.

J-2.3. Configuring a Bertec Force Plate

An example of the Bertec tab of the Force Plate Setup window is shown in Figure J-4. Details are provided in the remaining paragraphs of this section. It is important to recognize that the parameters that are reported at any one time are ther parameters associated with only one force plate. If you are using two force plates you need to establish the configuration parameters for each one of them. The plate for which the parameters correspond is indicated in the **Plate** box located in the Force Plate Setup window just above the tabs.

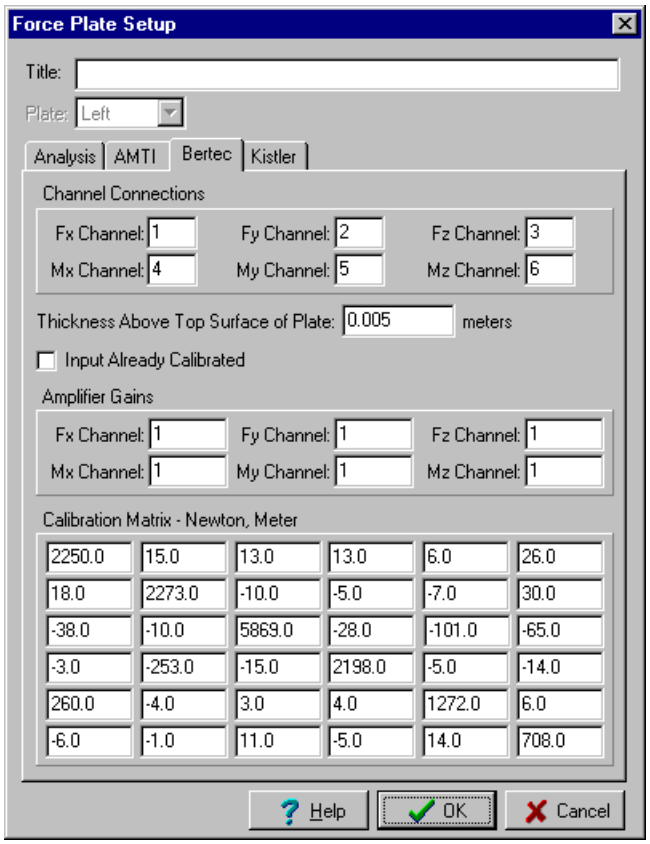


Figure J-4. An example ot the Bertec tab of the Force Plate Setup window.

Channel Connections: Bertec force plates produce six analog output signals. Identify the input channel of your acquisition system that was used to acquire each type of output in the eight boxes labeled **Fx Channel** through **Mz Channel**. For example, if the Fx output signal from the force plate was recorded on channel 1 of your acquisition system, then enter "**1**" in the box labeled **Fx Channel**.

Thickness Above Top Surface of Plate: The distance (in meters) between the actual surface of the plate and the working surface. For example, if you covered the surface of the plate with a plywood panel, enter the thickness of the panel here.

Input Already Calibrated: Check this check box if the force and moment data in the open data file have already been converted to force and moment units (as opposed to raw voltage). This is sometimes

the case in data files that were not acquired within DATAPAC itself. For example, data files acquired with Peak Performance systems are almost always converted to force and moment units.

Amplifier Gains: Each of the six analog output signals has a user-selectable gain value associated with it. Enter the gains you have selected for each channel in the six boxes provided in this section.

Calibration Matrix: Enter the values into this matrix exactly as they appear on the calibration sheet provided with your equipment.

J-2.4. Configuring a Kistler Force Plate

An example of the Kistler tab of the Force Plate Setup window is shown in Figure J-5. Details are provided in the remaining paragraphs of this section. It is important to recognize that the parameters that are reported at any one time are ther parameters associated with only one force plate. If you are using two force plates you need to establish the configuration parameters for each one of them. The plate for which the parameters correspond is indicated in the **Plate** box located in the Force Plate Setup window just above the tabs.

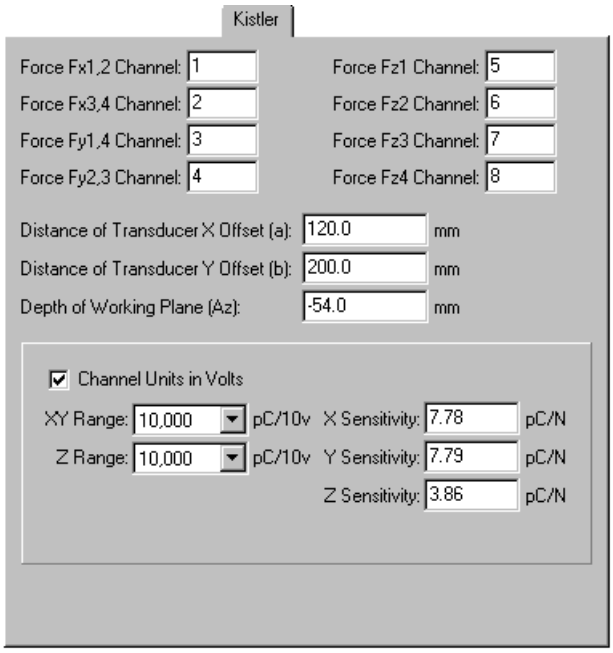


Figure J-5. An example ot the parameter window used to set up a Kistler force plate.

Force Fx1,2 Channel - **Force Fz4 Channel:** Kistler force plates produce a total of eight analog output signals. Identify the input channel of your acquisition system that was used to acquire each type of output in the eight boxes labeled **Force Fx1,2 Channel** through **Force Fz4 Channel**. For example, if the Fx1,2 output signal from the force plate was recorded on channel 1 of your acquisition system, then enter "**1**" in the box labeled **Force Fx1,2 Channel**.

Distance of Transducer X Offset (a): The distance (in millimeters) between the force plate's transducers in the X dimension. The X dimension is the plate's short (usually lateral) axis.

Distance of Transducer Y Offset (b): The distance (in millimeters) between the force plate's transducers in the Y dimension. The Y dimension is the plate's long (usually the anterior-posterior) axis.

Depth of Working Plane (Az): The distance (in millimeters) between the top of the force plate and the transducers.

Channel Units in Volts: Check this check box if the force data in the open data file have already been converted to volts. This is sometimes the case in data files that were not acquired within DATAPAC itself. For data files acquired with Peak Performance systems are almost always converted to volts.

XY Range Selection: Output range of the charge amplifiers in the X and Y dimensions in pC. **Note:** The full scale range of your A-D board must be set at +/- 10 volts.

Z Range Selection: Output range of the charge amplifiers in the Z dimension in pC. **Note:** The full scale range of your A-D board must be set at +/- 10 volts.

X, Y, Z Sensitivities: The full scale range sensitivities of the charge amplifiers. They are found on the calibration sheet provided with your equipment.

J-3. Force Components Time Series Graphs

Time series graphs are used to plot force, moment, and/or center of pressure data over time. An example of a time series graph, showing the component forces recorded in the X, Y, and Z dimensions over the course of a trial, is shown in Figure J-6.

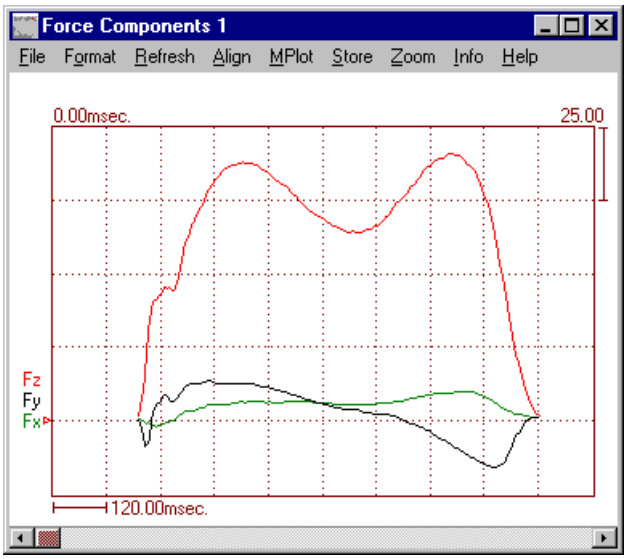


Figure J-6. An example of a time series graph display window. This example shows component forces in three dimensions over the course of a trial.

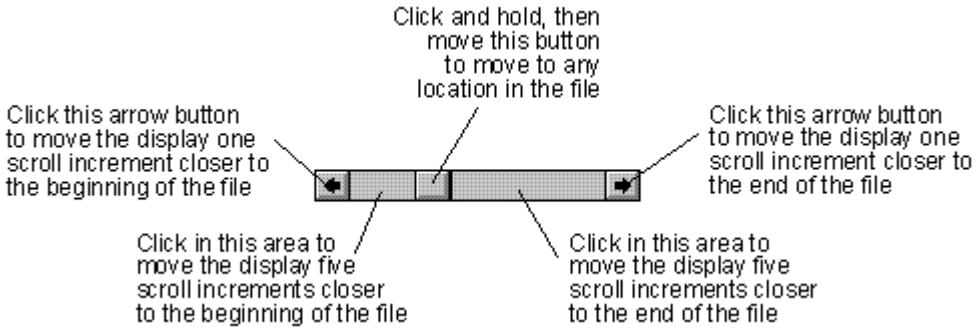
The time series graph windows in the Force Plate Analysis module are, in most respects, identical to the display windows that Datapac 2K2 provides for viewing raw data in time series. The only important difference is that the window plots computed force, moment, or center of pressure data rather than individual channels of raw data. However, each force, moment, or center of pressure trace is still called a "channel".

One other difference is the fact that it is possible to suppress plotting data for segments of the data file where the Fz component force is within a user-selected range of zero. In the illustration provided above, for example, notice that no data are plotted for the first 180 milliseconds and the final 120 milliseconds of the display. The plot suppression threshold level is established within the **Analysis** tab of the Force Plate Setup window. See Section J-2-1 for details.

When initially opened the display window employs the parameters that were in effect when a time series graph window was last closed. You can adjust the characteristics of the display by loading a previously saved parameter file or by using the **Format** option in the menu bar at the top of the window. Some of the display parameters can also be changed by interacting with *hot spots* built into the display. The available hot spots are described in Section J-3.1.

J-3.1. Hot Spots Available in Time Series Graph Displays

Scrolling: Scrolling refers to an incremental adjustment of the display's starting time without affecting its duration. Scrolling is easily effected by clicking on the various elements of the scroll bar built into the bottom edge of the display window. The illustration below summarizes the results you can achieve. The **scroll increment** value can be adjusted in the Display tab of the Format window. See Section J-3.2 for details. If you want to start the display at a specific value, position the mouse pointer on the starting time value reported above the top left corner of the display box, hold down the ALT key, then click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Display** tab, and highlights the display **Starting Time** value so that it may be easily changed.



Align (Position) Individual Channels: Move the mouse pointer outside the left edge of the display box and position it on the number or title of the channel you wish to move. Hold down the shift key and hold the left mouse button as you move the mouse. As you do so a horizontal line appears in the display box to monitor the zero reference level of the channel as you move it. A message also appears in the bottom right corner of the window identifying the channel being moved.

Note: If all channels move simultaneously, select the **Align|Space** option in the display window's menu bar to separate them. Then you can move them individually.

Adjust Time Base: Position the mouse pointer on the time base value located below the bottom left corner of the display box, hold down the CTRL key, then click the left mouse button to increase the time base (i.e., to increase the time interval represented by the distance between successive grid lines) or click the right button to decrease it. The method just described increases or decreases the time base by a factor of two with each implementation. To achieve a more finely tuned adjustment, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Display** tab, and highlights the display **Duration** value so that it may be easily changed.

Zooming In or Out: Position the mouse pointer on the location in the display you want to zoom in or out around, hold down the CTRL key, then click the left mouse button to zoom in, or click the right button to zoom out. This method of zooming in or out is similar to using hot spots to adjust the time base, as just described, except that this method also centers the selected location in the display.

Note: Zooming can also be achieved using the Zoom option in the display window's menu bar.

Adjust Display Gain of Individual Channels: Move the mouse pointer outside the left edge of the display box and position it on the number or title of the channel you wish to adjust. Hold down the CTRL key and click the left mouse button to double the gain, or click the right button to reduce it by half. To achieve a more finely tuned adjustment, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Channel** tab, selects the corresponding channel, and highlights its **Gain** value so that it may be easily changed.

Adjust Y-Scale Value: Position the mouse pointer on the Y-Scale value reported above the right corner of the display box. Hold down the CTRL button and click the left mouse button (to reduce the value by one half) or click the right mouse button (to double the value). To achieve a more finely tuned adjustment, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Display** tab, and highlights the **Y-Scale** value so that it may be easily changed.

Change the Display Title: Position the mouse pointer on the existing title of the display (or on the space directly below the menu bar, if no title currently exists), hold down the ALT key, and click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Display** tab, and highlights the current **Title** so that it may be easily changed.

J-3.2. Formatting a Time Series Graph.

The **Format** window, accessed through the **Format** option of the display window's menu bar, is used to set the parameters that affect the appearance of the display. It is broken down into three tabbed sections: **Display**, **Channels**, and **Information**. They are described briefly below.

Display: Add, edit, or remove a title to the display, change the starting time, duration, scroll increment, and overall amplitude scale, turn on/off grid and change its characteristics, turn on/off multiplot mode and other features.

Channels: Add and remove individual channels (i.e., force, moment, or center of pressure signals) from the display, change their display gains individually, apply and adjust amplitude offset values, mark data points with symbols, display only the data points or connect them with lines.

Information: Select channels to monitor with the **Info** command cursors, select between level and time/amplitude information modes.

☞ Many of the parameters contained in the **Channels** and **Display** tabs can be more quickly adjusted via hot spots on the display itself. See Section J-3.1 for information on the available hot spots in a time series display.

The contents of the **Display** and **Channels** tabs determine the contents and appearance of the display itself. They are described in detail in the remainder of the present section. The **Information** tab, on the other hand, controls the behavior of the **Info** feature, the feature provided for obtaining time and amplitude measurements from the display. The Information tab, as well as the Info feature itself, is described in Section J-3.3.

The Display Tab

The Display tab of the Format parameter window contains the parameters that control the overall appearance of the corresponding time series display. An example of the Display tab is shown in Figure J-7. Each option is described in the following paragraphs.

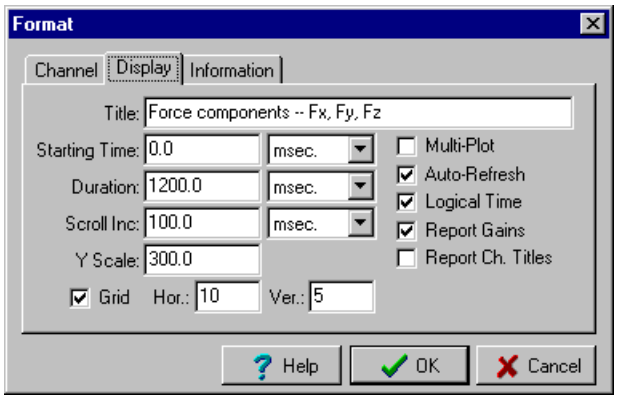


Figure J-7. An example of the Format window showing the contents of the Display tab.

Title: The display title is a text string that you feel best describes the contents of the display. The title appears in the line just below the display window's menu bar. If you save the display parameters to a parameter file, the display title also serves as the file title, and you can use it as a long file name when retrieving the file.

Starting Time: Determines the starting time of the display, relative to the beginning of the data file (which is always defined as time = 0). The Starting Time parameter is actually composed of two values, represented by the two boxes to the right. The second box determines the units of time used to interpret the value entered in the first box. The selected units are also used to report the starting time within the display itself.

Duration: Determines the duration of the display. The Duration parameter is actually composed of two values, represented by the two boxes. The second box determines the units of time used to interpret the value entered in the first box. The time base value, which is reported in the display below the bottom left corner of the display box, is always equal to the duration value divided by the number of horizontal divisions in the **Grid**.

Scroll Increment: Determines the interval of time that is added to, or subtracted from, the display's starting time each time you select one of the arrows on right or left edges of the scroll bar indicator presented at the top left edge of the display window. To move five times the scroll increment, select the space to either side of the button in the scroll bar. The Scroll Increment parameter is actually composed of two values, represented by the two boxes. The second box determines the units of time used to interpret the value entered in the first box. There are four time unit options: **usec** (microseconds), **msec** (milliseconds), **sec** (seconds), and **% Dur**. The % Dur option allows you to set the scroll increment equal to a percentage of the current display duration value. The percentage value is entered in the box to the left. For example, if you enter the value, 50 in the left box and set the time units option to % Dur, then the scroll increment is equal to 50% of the display duration. When you change the display duration you also change the scroll increment.

Y-Scale: Determines the change in amplitude represented by one division of the display grid in the vertical dimension. The Y-Scale value applies to all channels within the display. It is unitless since the amplitude of each channel (i.e., force, moment, or center of pressure signal) may be measured in different units, depending upon the type of signal it is. Also note that each channel in the display

possesses its own individually adjustable gain value. Therefore, to determine the amplitude change represented by one division of the display grid for any given channel, divide the channel's gain value by the Y-Scale value. For example, if the Y-Scale value is 100, and a given channel's gain value is set at 5, then the amplitude difference represented by the distance between two successive grid lines is 20 (100 / 5 = 20).

Grid, Horizontal, and Vertical: The **Grid** check box turns the display grid on and off. When the box is checked a grid of horizontal and vertical lines appears in the display. When unchecked the grid does not appear. The values entered in the **Hor[izontal]:** and **Ver[tical]:** boxes indicate the number of grid lines in each dimension.

Multi-Plot: Turns the multi-plot feature on and off. This check box operates in conjunction with the MPlot command in the display window's menu bar. When the multi-plot feature is off the existing contents of the display are erased whenever the screen is regenerated as a result of a scroll. In contrast, when the multi-plot feature is on the existing contents of the display are preserved when a scroll is effected and the new information is superimposed over the existing information. Note that adjusting any other characteristic of the display (such as changing its size or turning one or more channels on and off) eliminates the previous contents of the display regardless of whether or not the multi-plot feature is on or off. However, when the muti-plot feature is on, the previous contents of the display can be recovered by selecting the **Refresh** command in the display window's menu bar.

Auto-Refresh: Turns the auto-refresh feature on and off. When the auto-refresh feature is on the display is automatically regenerated (refreshed) whenever any characteristic of the display is changed (e.g., when the display is resized, or when any channel or display parameter is changed). When auto-refresh feature is off the display is only refreshed when you select the **Refresh** option in the menu bar along the top of the display window. Usually it is a good idea to turn the auto-refresh feature off only when it takes a long time to refresh the display.

Logical Time: When this box is cleared the analog data are displayed in **physical time** coordinates. When checked the data are displayed in **logical time** coordinates. Physical time refers to a way of measuring time relative to the beginning of a data file and based on the physical characteristics of that file. Physical time notation ignores the presence of possible time gaps which would have occurred if the data file was acquired in a discontinuous fashion, and assumes the data were acquired continuously. Logical time refers to a way of measuring time relative to the beginning of an acquisition session. Logical time notation takes into account the presence of possible time gaps between successively acquired segments of the data file, such as successively acquired sweeps in the triggered sweep acquisition mode.

Report Gains: Check this box if you want to report the display gains of each channel in the display. The display gains are indicated in parentheses after the corresponding channel number, along the left edge of the display. **Note:** Divide the channel's gain by the Y-Scale value to obtain a measure the signal amplitude per division of the display grid.

Report Channel Titles: Check this box if you want to identify each channel in the display by its title. Clear the box if you want to identify each channel by its number.

The Channels Tab

The Channels tab of the Format window contains the parameters which determine the individual channels (i.e., force, moment, or center of pressure signals) that appear in the display, as well as the parameters that control the appearance of the individual channels when they appear. An example of the Channels tab is shown in Figure J-8. The location of the highlight within the **Ch/Buf** list box along left edge of the window determines the channel of the data file whose parameters are reported to the right.

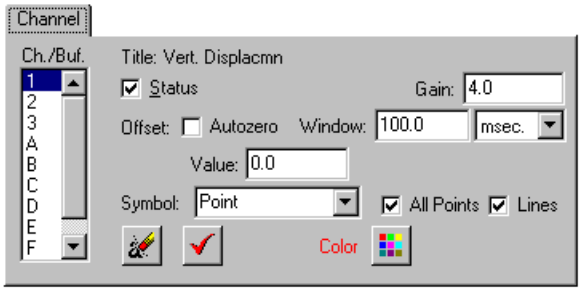


Figure 2.8. An example of the Format window's Channel tab.

Ch/Buf. list box: This list box lists the active channels and the active event buffers of the data file. The parameters reported on the right side of the window are associated with the channel currently highlighted in the list box. Consequently, as you highlight different channels or buffers the parameter values change accordingly. One of the parameters listed on the right side of the window is the **Status** check box, which determines if the channel or buffer appears in the display. Thus, if you want the highlighted channel or buffer to appear in the display, check the status check box. If you don't want it to appear, clear the check box. You can also add or remove channels or event buffers by double-clicking on the channel number or event buffer letter in the **Ch/Buf.** list box.

Status: This check box determines whether the highlighted channel or event buffer appears in the display. Check the box to include the highlighted channel or buffer, or clear it to exclude it from the display. Note that you can also double-click on the channel number of event buffer letter in the **Ch/Buff** list box to include or exclude the corresponding item from the display.

Gain: The gain parameter sets the display gain for the highlighted channel or event buffer. It works by multiplying the amplitude value of each data point by the specified gain value. The units of measurement for the channel in question are determined by the calibration parameters established for it. Thus, they may be different for each channel or buffer. **Note:** Divide the channel's gain by the Y-Scale value to obtain a measure the signal amplitude per division of the display grid.

Autozero[1]**:** The **Autozero** check box turns the autozero feature on and off. When the autozero feature is on the program calculates the mean amplitude of the first series of data points for the associated channel or event buffer (starting from the beginning of the display) and sets the offset value to the obtained mean *plus* the selected **Value** parameter. The number of data points contributing to the calculation is determined by the value of the **Window** parameter.

Window: The Window parameter determines the number of data points involved in the calculation of the channel's or event buffer's mean amplitude. The mean amplitude is then used to auto-zero the trace in the display. The Window always starts at the beginning of the display. For example, if the channel was acquired using a sampling rate of 10 KHz, then an offset window of 5 milliseconds would contain 50 data points. Thus, an average is obtained for the first 50 data points within the display for that channel. The offset **Value** parameter is then added to the result of the average calculation to obtain

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[1] The autozero feature is most effectively used when the average amplitude of the corresponding signal is significantly different than zero.

the magnitude of the offset applied to the channel. When the **Autozero** check box is unchecked the Window parameter has no effect (but the **Value** parameter still does).

Value: When the **Autozero** check box is unchecked the Value parameter directly determines the magnitude of the offset applied to the channel or event buffer. When the Autozero check box *is* checked, however, the mean amplitude of the channel is determined for the duration indicated by the Window parameter, and *then* the Value parameter is applied to the result. The units of measurement employed are determined by the calibration parameters established for the channel in question.

Symbol: This list box determines the type of symbol used to mark the locations of the data points plotted for the highlighted channel or buffer. Note that when the **All Points** check box is checked every plotted data point is marked with the selected symbol. In contrast, when the **All Points** check box is not checked, only the data points with the minimum and maximum amplitude values within each pixel column are marked with symbols.

Lines: When this check box is checked successively plotted data points are connected with lines. When the check box is cleared the individual data points are not connected.

All Points: When this check box is checked every plotted data point in the highlighted channel or buffer is marked with a symbol. When it is unchecked, then only the data points with the minimum and maximum values within each pixel column are marked with symbols. Display generation is often substantially faster when the All Points check box is unchecked. Also, if you are using the Point symbol type and you are connecting the points with lines, the appearance of the display will be exactly the same regardless of whether the all points box is checked or not. Therefore, under these conditions, leave the box unchecked to optimize display generation time.

 **(Clear All),**  **(Select All):** The  button clears the status check boxes associated with all channels (and buffers), thus deleting all of the channels from the display. The  button checks the status check boxes associated with all channels (and buffers), thus adding all of the channels to the display.

Color: This item is printed in the color currently selected for displaying the data associated with the highlighted channel. To change the channel's display color, click the  button to access a color palette window. When the palette window appears, one of the colors is surrounded by a dotted box to indicate the currently selected color.

☞ On occasion the color displayed on the screen does not exactly match the color selected from the palette. That is because lines can only be displayed in "pure" colors, i.e., colors that a single pixel can take on. Some display hardware can produce only 8 or 16 pure colors. Additional colors are achieved by a process called dithering. Dithering is available for coloring area fills but not lines. Signal traces are considered lines.

J-3.3. Using the Info Command in a Time Series Display

The **Info** command has two modes of operation: **Time & Amplitude** and **Level**. The **Time & Amplitude** mode inserts up to four vertical cursors into the time series display to monitor the time and amplitude of the signals of selected channels where they intersect with the cursors. The Time & Amplitude mode also has a Statistics option, reporting a variety of descriptive statistics about a region bounded by the cursors. The **Level** mode inserts up to four horizontal cursors to measure amplitude relative to the zero reference point of selected channels. The operation of each of the two modes are described in detail in later paragraphs of this section.

The general operation of the Info feature is illustrated in Figure J-9. Specifically, the illustration shows the Info feature within the Time & Amplitude mode, but the principles are the same in the Level mode as well.

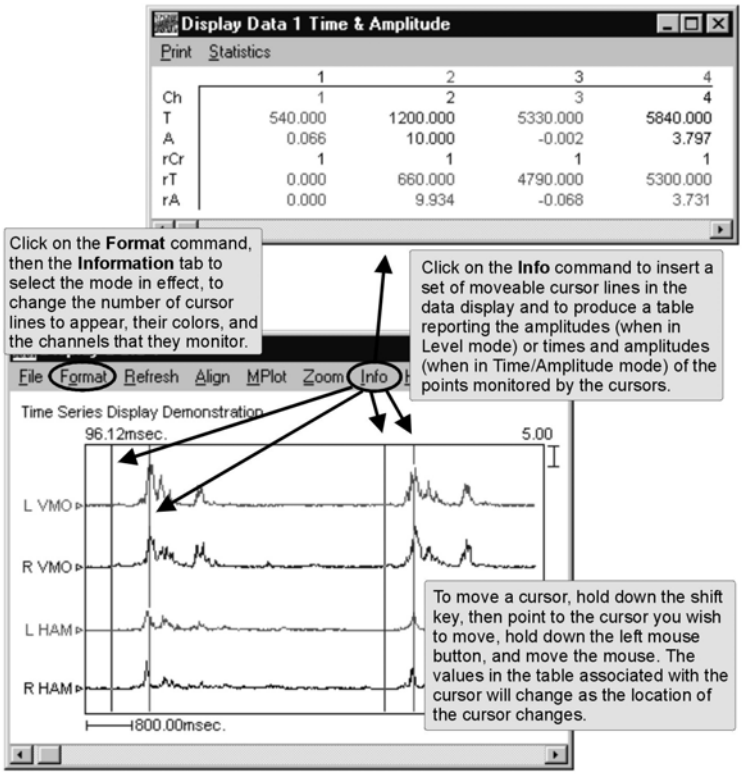


Figure J-9. An example of a time series display and companion table window when the Time & Amplitude option of the Info command is in effect.

To activate the Info feature, select the **Info** option from the display window's menu bar. Two things occur when the Info feature is in effect: (1) Up to four cursors appear in the time series display, and; (2) a companion window appears containing a table to report the values monitored by the cursors. Since the Time & Amplitude mode is in effect in the illustration presented in Figure J-9, the cursors appear as vertical lines, and the companion window reports both time and amplitude information. If the Level mode was in effect the cursors would appear as horizontal lines, and only amplitude information would be reported in the table in the companion window.

In either case, the locations of the four possible cursors can be moved individually. To move a cursor, hold the shift key down, place the tip of the mouse pointer on (or close to) the cursor you wish to move, then hold down the left mouse button as you move the mouse. As the cursor moves, the values in the table in the companion window change accordingly.

The Time and Amplitude Mode

When the Time & Amplitude mode is in effect the body of the table in the companion window consists of six lines and up to four columns. Each column is labeled with a number identifying the cursor whose information is reported below it. The color of the number corresponds to the color of the cursor in the display. Each remaining line is labeled with a descriptor: Ch, T, A, rCr, rT and rA, as described below. The information is also summarized in Figure J-10.

Ch: Reports the number of the channel being monitored by the cursor. The color of the channel number is the color of the same channel in the display.
T: Reports the time associated with the cursor, as measured from the beginning of the data file.
A: Reports the amplitude of the signal in the channel monitored by the cursor. Amplitude is reported in whatever units have been defined for the corresponding channel.
rCr: Reports the number of the cursor used as the reference for relative time and amplitude measurements. The color of the number corresponds to the color of the cursor in the display. Each cursor can use a different reference cursor.
rT: Reports the time associated with the cursor, as measured relative to the time reported for the selected reference cursor.
rA: Reports the amplitude associated with the cursor, as measured relative to the amplitude reported for the selected reference cursor.

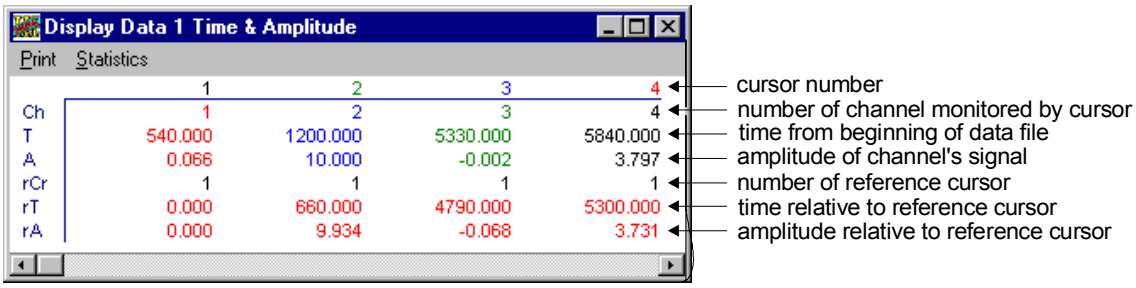


Figure J-10. An example of the companion window that appears when the Info command is active in the Time & Amplitude mode.

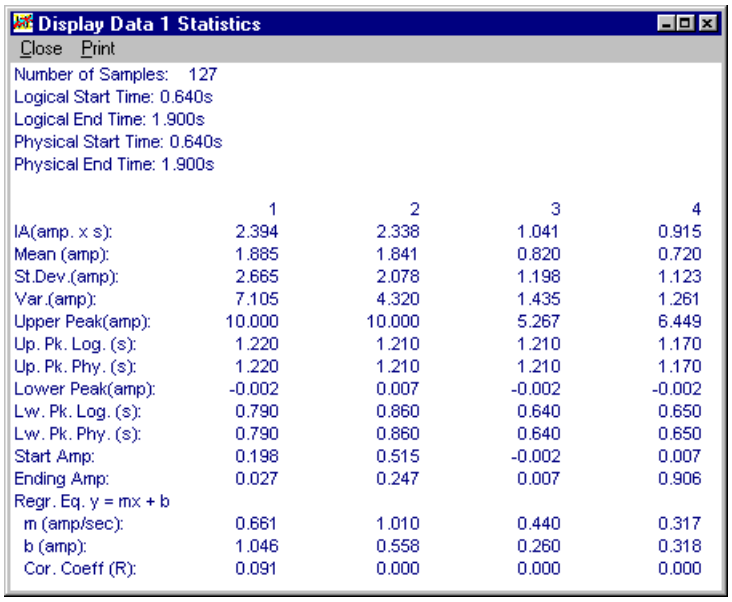
The Level Mode

When operating in the **Level** mode the table in the companion window consists of only four lines and up to four columns. Again, each column is labeled with a number identifying the cursor whose information is reported below it. The color of the number corresponds to the color of the cursor in the display. Each remaining line is labeled with a descriptor: Ch, A, rCr, and rA, as described below.

Ch: Reports the number of the channel being monitored by the cursor. The color of the channel number is the color of the same channel in the display.
A: Reports the amplitude of the signal in the channel monitored by the cursor. Amplitude is reported in whatever units have been defined for the corresponding channel.
rCr: Reports the number of the cursor used as the reference for relative amplitude measurements. The color of the number corresponds to the color of the cursor in the display. Each cursor can use a different reference cursor.
rA: Reports the amplitude associated with the cursor, as measured relative to the amplitude reported for the selected reference cursor.

Statistics

A statistics feature is built into the Time & Amplitude mode. To use it, click the Statistics option in the information table's menu bar. An example of the statistics window that appears is shown in Figure J-11. As the example illustrates, the table reports the number of samples (data points) in the interval, its left and right limits (boundaries), and then lists several statistics computed over the selected interval for each of the two channels monitored by each cursor, as well as the difference between them. These statistics include integrated amplitude (IA), mean amplitude, standard deviation and variance of the mean, the minimum and maximum amplitude (lower peak and upper peak) and the time that they occurred, the amplitude at the left and right boundaries (limits) of the interval, the slope and intercept of the regression line computed for amplitude over time and the correlation coefficient.



	1	2	3	4
IA(amp. x s):	2.394	2.338	1.041	0.915
Mean (amp):	1.885	1.841	0.820	0.720
St.Dev.(amp):	2.665	2.078	1.198	1.123
Var.(amp):	7.105	4.320	1.435	1.261
Upper Peak(amp):	10.000	10.000	5.267	6.449
Up. Pk. Log. (s):	1.220	1.210	1.210	1.170
Up. Pk. Phy. (s):	1.220	1.210	1.210	1.170
Lower Peak(amp):	-0.002	0.007	-0.002	-0.002
Lw. Pk. Log. (s):	0.790	0.860	0.640	0.650
Lw. Pk. Phy. (s):	0.790	0.860	0.640	0.650
Start Amp:	0.198	0.515	-0.002	0.007
Ending Amp:	0.027	0.247	0.007	0.906
Regr. Eq. y = mx + b				
m (amp/sec):	0.661	1.010	0.440	0.317
b (amp):	1.046	0.558	0.260	0.318
Cor. Coeff (R):	0.091	0.000	0.000	0.000

Figure J-11. An example of the Statistics window associated with the Info command's Time & Amplitude mode.

Two things about the statistics window are important to understand. First, ***the same interval is measured for all channels -- the interval between Cursors 1 and 2***. Cursors 3 and 4 are not used for the purpose of defining intervals for the statistics table. But that is not to say that the channels assigned to them are not reported. Rather, ***all channels that have been assigned to at least one cursor are reported in the table***. It does not matter to which cursor a given channel is assigned. Consequently, because there are four possible cursors, and because each cursor can monitor a different channel, the statistics window can report statistics for a maximum of four channels at a time.

Selecting the Desired Mode and Setting Up the Parameters:

To select the desired mode, and to set the parameters for each mode, select the **Format** option in the companion window's menu bar. Alternatively, select the **Format** option in the display window's menu bar, then click on the **Information** tab. An example of the Information tab is shown in Figure J-12.

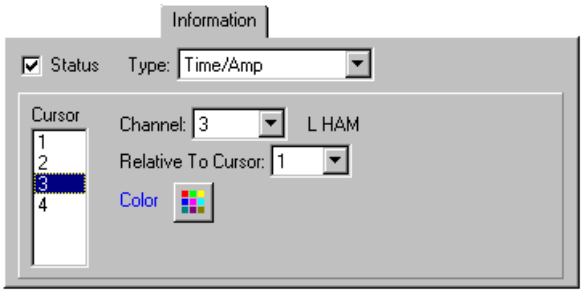


Figure J-12. An example of the Information tab in the Format parameters window.

The **Type** box is where you indicate which mode you wish to use. In either case there are four cursors available, and they are listed as numbers 1 - 4 in the **Cursor** list box. The remaining three parameters to the right report the values associated with the cursor currently highlighted in the Cursor list box.

The **Channel** box reports the channel that the currently highlighted cursor monitors in the display. You can select any channel in the data file, even one that does not appear in the display. If you select the **None** option, the cursor is disabled – i.e., it does not appear in the display and no data are reported for it. The **Relative to Cursor** box reports the cursor used as a reference point for reporting relative amplitude and/or time values. For example, if the Relative to Cursor parameter is set to "3", then relative time and amplitude values are reported for the channel monitored by cursor #3. Note that relative values are reported only when the cursor indicated in the Relative to Cursor box is enabled. The **Color** item is presented in the color used to present the cursor itself in the display. To cursor's display color, click the  button to access a color palette window. When the palette window appears, one of the colors is surrounded by a dotted box to indicate the currently selected color.

J-4. Force Component X-Y Graphs

XY graphs are most commonly used to plot center of pressure data computed for the the X versus Y dimensions, over a selected interval of time. However, an XY graph can also be used to plot force components or moments against each other as well. An example of an XY plot graph is illustrated in Figure J-13, showing center of pressure computed for the X dimension (Ax) versus the Y dimension (Ay) over the course of a trial.

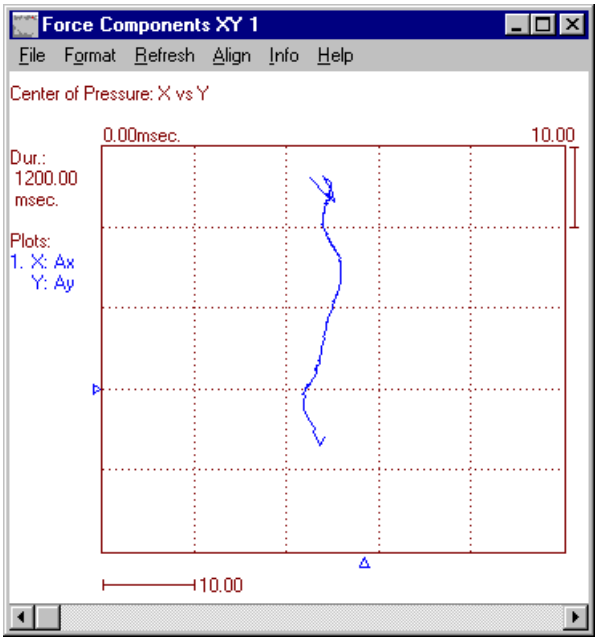


Figure J-13. An example of an X-Y graph display window.

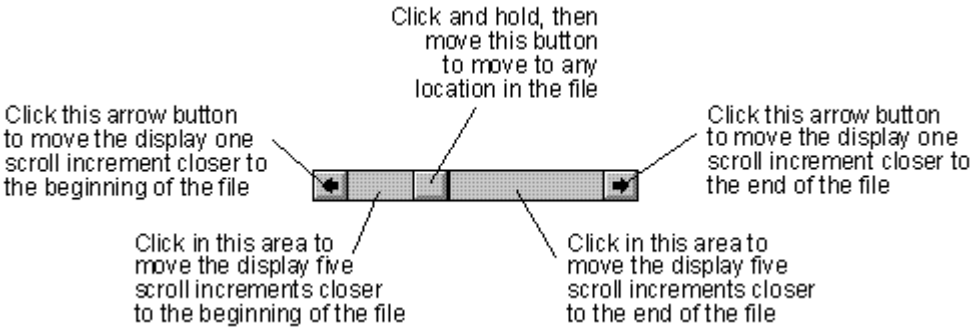
The X-Y graph window in the Force Plate Analysis module is, in most respects, identical to the X-Y Plot display windows that Datapac 2K2 provides for viewing raw data. The only important difference is that the window plots computed force, moment, or center of pressure data rather than raw data. However, each force, moment, or center of pressure trace is still called a "channel".

One other difference is the fact that it is possible to suppress plotting data for segments of the data file where the Fz component force is within a user-selected range of zero. The plot suppression threshold level is established within the **Analysis** tab of the Force Plate Setup window. See Section J-2.1 for details.

When initially opened the display window employs the parameters that were in effect when the window was last closed. You can adjust the characteristics of the display by loading a previously saved parameter file or by using the **Format** option in the menu bar at the top of the window. The **Format window**, accessed through the Format option, contains two tabs -- **Display** and **Plots**. The **Display tab** contains the parameters that control the over-all appearance of the display. The **Plot** tab contains the parameters controlling the appearance of each of up to four individual plots that you can elect to include in the display. Some of the display parameters can also be changed by interacting with specific *hot spots* built into the display. The available hot spots are described in Section J-4.1.

J-4.1. Hot Spots Available in X-Y Graph Displays

Scrolling: The display scroll bar, built into the bottom border of the display window, lets you change the display's starting time, thus effectively moving the display to different locations in the data file. Click on the left and right arrows at the sides of the bar to move backward and forward through the data file by a time increment equal to the *scroll increment* value (which can be adjusted within the Display tab of the Format window; see section J-4.2). Click on the spaces on either side of the middle button to move backward and forward through the data file by a time increment equal to five times the scroll increment value. Click and hold on the middle button and move it through the scroller bar to move the display to any desired location in the data file. The operations just described are summarized in the illustration below.



Align (Position) Individual Plots: The zero reference points in the X and Y dimensions are indicated for each plot with arrowheads just outside the left and bottom borders of the display box, and they are presented in the same color as the plot itself. To adjust the position of a plot, hold down the shift key on the keyboard, move the mouse pointer onto one of the arrowheads, then hold down the left mouse button as you move the mouse. A line appears in the display to indicate the position of the zero reference point as you move it.

Adjust Duration: The duration of the display is indicated to the left of the display box. To change the duration, hold down the CTRL key on the keyboard, position the mouse pointer on the current duration value, and click the left or right mouse button to respectively increase or decrease the current value by a factor of two each time. To achieve a more finely tuned adjustment, hold down the ALT key, position the mouse pointer on the current duration value, and click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Display** tab, and highlights the display **Duration** value so that it may be easily changed.

Adjust Display Gain of Individual Plots: The channels contributing to each plot are reported to the left of the display box. The relative zero points of the X and Y axes are indicated for each plot in the display with arrowheads along the left and bottom borders of the display box. Both the channel list and the relative zero point indicators are presented in the same color as the plot itself. To increase or decrease the gain of a plot in *both* the X and Y dimensions, position the mouse pointer on the list of channels for the corresponding plot, hold down the CTRL key on the keyboard, and click the left or the right mouse button, respectively. To increase or decrease the gain of a plot in *either* the X *or* the Y dimension, position the mouse pointer on the arrowhead indicating the relative zero reference for the corresponding plot, hold down the CTRL key on the keyboard, and click the left or the right mouse button, respectively. Finally, to achieve a more finely tuned adjustment, hold down the ALT key, position the mouse pointer on the desired zero reference arrowhead, click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Plots** tab, and highlights the **Gain** value of the corresponding channel so that it may be easily changed.

Adjust Y-Scale Value: Adjusting the Y-scale value affects the magnitude of all plots in the display. To adjust the Y-scale value, position the mouse pointer on the Y-Scale value reported above the right

corner of the display box, hold down the CTRL key on the keyboard, and click the left or right mouse button to respectively increase or decrease the current value by a factor of two each time. To achieve a more finely tuned adjustment, position the mouse pointer on the Y-Scale value, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Display** tab, and highlights the **Y-Scale** value so that it may be easily changed.

Adjust X-Scale Value: Adjusting the X-scale value affects the magnitude of all plots in the display. To adjust the X-scale value, position the mouse pointer on the X-Scale value reported below the bottom left corner of the display box, hold down the CTRL key on the keyboard, and click the left or right mouse button to respectively increase or decrease the current value by a factor of two each time. To achieve a more finely tuned adjustment, position the mouse pointer on the X-Scale value, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Display** tab, and highlights the **X-Scale** value so that it may be easily changed.

Change the Title: Position the mouse pointer on the existing title of the display (or on the space directly below the menu bar, if no title currently exists), hold down the ALT key, and click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Display** tab, and highlights the current **Title** so that it may be easily changed.

J-4.2. Formatting an X-Y Plot Graph

The **Format** window is used to set the parameters that affect the appearance of the display. It is broken down into two tabbed sections: **Display** and **Plots**. The contents of each tab are described briefly below.

Display: Add, edit, or remove a title to the display, change the starting time, duration, scroll increment, X and Y Scale values, turn on/off the grid and change its characteristics, turn on/off multiplot mode and other features. Details are provided in below.

Plots: Add and remove individual plots from the display, change channels and individual display gains, apply and adjust amplitude offset values, mark data points with symbols, display only the data points or connect them with lines. Details are provided in at the end of this section.

The Display Tab

The display tab contains the parameters that govern the overall appearance of a display. An example is shown in Figure J-14. Each option is described in the remaining paragraphs of this section. You may have already noticed that the Display tab used by X-Y graphs in the Force Plate Analysis module is identical in both function and appearance to the Display Parameters Window used by the standard X-Y plot display windows Datapac 2K2 employs for viewing raw data.

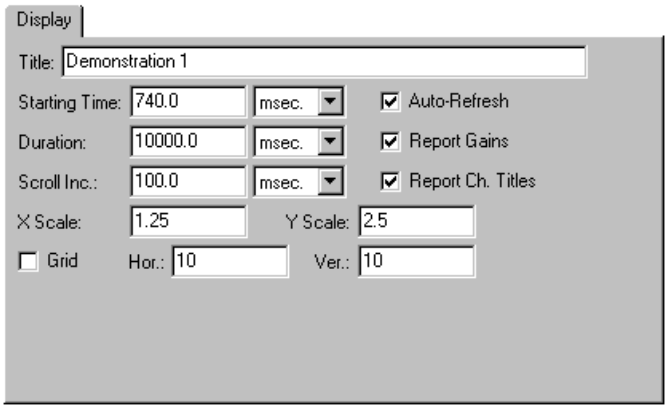


Figure J-14. An example of the Display tab in the Format window associated with X-Y graph displays.

Title: The display title is any text string that you feel best describes the contents of the display. In the display itself, the title appears above the display box, just to the right of the scroll bar. If you save the display parameters to a parameter file, the display title also serves as the file title, and you can use it as a long file name when you retrieve the file.

Starting Time: Determines the starting time of the display, relative to the beginning of the data file (which is always defined as time = 0). The Starting Time parameter is actually composed of two values, represented by the two boxes to the right. The second box determines the units of time used to interpret the value entered in the first box. The selected units are also used to report the starting time within the display itself.

Duration: Determines the duration of the display. The Duration parameter is actually composed of two values, represented by the two boxes. The second box determines the units of time used to interpret the value entered in the first box. The selected units are also used to report the duration value within the display itself.

Scroll Increment: Determines the interval of time that is added to, or subtracted from, the display's starting time each time you select one of the arrows on right or left edges of the scroll bar along the bottom edge of the display window. To move five times the scroll increment, select the space to either side of the button in the scroll bar.

The **Scroll Incr**ement value can be expressed in microseconds (usec), milliseconds (msec), seconds (sec), or as a percentage of the current display duration (% Dur). For example, to establish a scroll increment of 100 milliseconds, enter **100** in the left-hand box on the **Scroll Incr.** line of the Display Parameters Window, and select the **msec** option in the right-hand box. Likewise, to establish a scroll increment value equal to 50% of the display duration, enter **50** in the left-hand box and select the **% Dur** value in the right-hand box. Note that when you select the % Dur option the scroll increment changes whenever you change the display duration.

X-Scale: Determines the change in amplitude represented by one division of the display grid in the horizontal dimension. The X-Scale value applies to all channels plotted along the X axis. The scale value is unitless since the amplitude of each channel may be measured in different units, depending upon the calibration parameters established for each. Also note that each channel in the display possesses its own individually adjustable gain value. Therefore, to determine the amplitude change represented by one division of the display grid for any given channel, divide the channel's gain value by the Y-Scale value. For example, if the Y-Scale value is 100, and a given channel's gain value is

set at 5, then the amplitude difference represented by the distance between two successive grid lines is 20 (100 / 5 = 20).

Y-Scale: Determines the change in amplitude represented by one division of the display grid in the vertical dimension. The Y-Scale value applies to all channels plotted along the X axis. The scale value is unitless since the amplitude of each channel may be measured in different units, depending upon the calibration parameters established for each. Also note that each channel in the display possesses its own individually adjustable gain value. Therefore, to determine the amplitude change represented by one division of the display grid for any given channel, divide the channel's gain value by the Y-Scale value. For example, if the Y-Scale value is 100, and a given channel's gain value is set at 5, then the amplitude difference represented by the distance between two successive grid lines is 20 (100 / 5 = 20).

Grid: Turns the display grid on and off. When the box is checked a grid of horizontal and vertical lines appears in the display. When unchecked the grid does not appear. Secify the number of divisions you want in each axis in the **Hor.** and **Ver.** boxes. Note that the X-scale and Y-scale values are always reported as if the grid was present.

Auto-Refresh: Turns the auto-refresh feature on and off. When the auto-refresh feature is on the display is automatically regenerated (refreshed) whenever any characteristic of the display is changed (e.g., when the display is resized, or when any channel or display parameter is changed). When auto-refresh feature is off the display is only refreshed when you select the **Refresh** option in the menu bar along the top of the display window. Usually it is a good idea to disable the auto-refresh feature only when it takes a long time to refresh the display.

Report Gains: Check this box if you want to report the display gains of each channel in the display. The display gains are indicated in parentheses outside the left edge of the display box, after the number, letter, or title of the corresponding channel or event buffer (event buffers cannot be included in X-Y Plot displays).

☞ Divide the channel's individual gain value by the Y-Scale value to obtain a measure the signal amplitude per division of the display grid.

☞ The display gain does not affect the amplitude of the channel as it is stored in the data file.

Report Channel Titles: Determines whether the channel titles or the channel numbers are reported in the display. Check the check box to report channel titles, or clear it to report channel numbers.

The Plots Tab.

The parameters contained in the Plots tab control the appearance of the individual plots presented in an X-Y plot display. An example is shown in Figure J-15. An X-Y plot display can contain up to four individual plots, and they are identified by number (1 - 4). The parameters reported in the Plots tab at any given time are associated with only of the four possible plots -- the one whose number appears in the **Plot Number** box. Thus, to gain access to the parameters associated with another plot, click on the Plot Number box and select a different number. The remaining parameters are described in the following paragraphs.

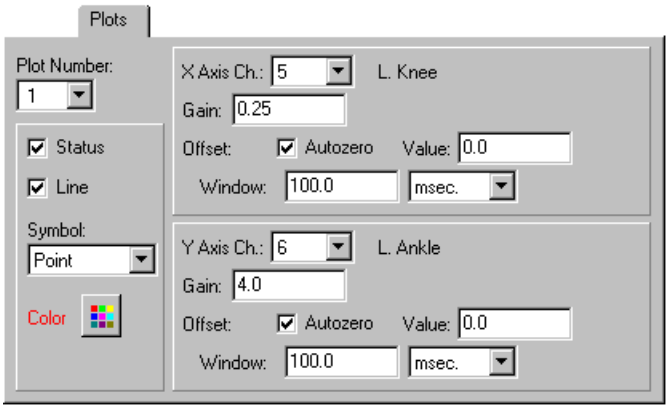


Figure J-15. An example of the Plots tab in the Format window associated with X-Y graph displays.

Status: Determines whether the plot appears in the display. Check the box to include the plot or clear it to exclude the plot.

Line: The line option determines whether successively plotted data points are connected with lines (Lines) or not (No Lines).

Symbol: Determines the type of symbol used to mark the locations of the data points that compose the plot.

Color: Reports the color used to present the plot in the display. The color is reported in terms of the intensity of its red, green, and blue components, respectively. To see the corresponding color, or to change the color, select the **Change Color** button to open a color palette window.

X Axis Ch.: Determines the channel that is plotted along the X-axis. To change the channel, click on the scroll box and then highlight the desired channel.

Y Axis Ch.: Determines the channel that is plotted along the Y-axis. To change the channel, click on the scroll box and then highlight the desired channel.

Gain: The gain parameter sets the display gain for the channel. It works by multiplying the amplitude value of each data point in the channel by the gain value. The units of measurement for the channel in question are determined by the calibration parameters established for it. Thus, they may be different for each channel.

Offset [Autozero, Window, and Value] (X-Axis): The offset parameters determine the placement of the channel plotted along the corresponding axis, relative to its zero reference point. There are three individual parameters within the set: **Autozero**, **Window**, and **Value**.

The **Autozero** check box turns the autozero feature on and off. When the autozero feature is on the program calculates the mean amplitude of the first series of data points (taken from the beginning of the display) for the associated channel and sets it to zero. The mean amplitude of the interval is therefore set to the zero reference point for that channel. The duration of the interval for which the mean in is calculated is determined by the value of the **Window** parameter. The mean amplitude is recalculated any time the starting time of the display is changed.

The **Value** parameter is added to the amplitude of each data point in the corresponding channel for the purposes of the display. When the Autozero box is checked the Value parameter is added to the amplitude value of each data point after the autozero function is performed as described in the preceding paragraph. When the Autozero box is clear the Value parameter is added to the raw amplitude value of each data point.

☞ Each channel's zero reference point is indicated in the display window with an arrowhead along the left edge of the display box.

☞ The autozero feature is most appropriately used when the mean of the interval indicated in the window parameter is the same, or nearly the same, regardless of which segment of the data file is being displayed.

☞ The offset feature affects the displacement of the channel *within the display only*. It has no effect on the amplitude measurements obtained and reported elsewhere for the channel.

J-5. 2D Vector Position Graphs

2D Vector Position Graphs are used to view forces as vectors with respect to force plate position. Three viewing orientations are possible: frontal, sagittal, and transverse. An example of a 2D position graph from a sagittal viewing orientation is shown in Figure J-16.

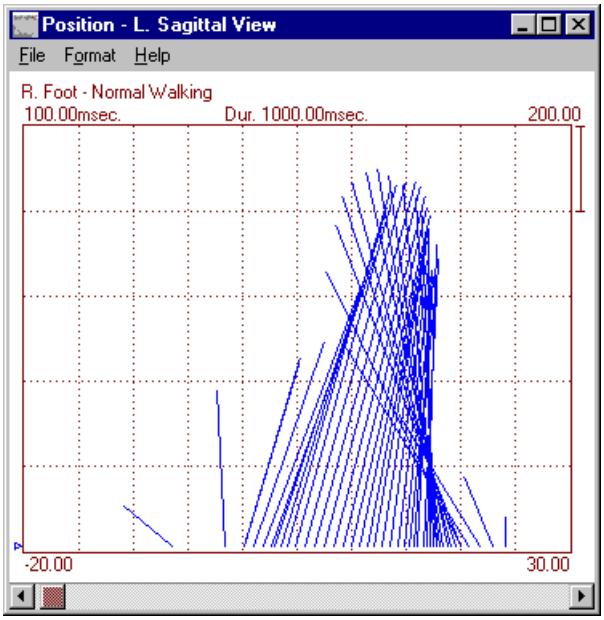


Figure J-16. An example of a 2D position graph display window (sagittal view).

When initially opened the display window employs the parameters that were in effect when the window was last closed. You can adjust the characteristics of the display by loading a previously saved parameter file or by using the **Format** option in the command bar at the top of the display window. Some of the display parameters can also be changed by interacting with *hot spots* on the display, as described in Section J-7.2.

J-5.1. Interpreting a 2D Vector Position Graph

Position graphs show force data as a series of vectors, with each vector representing the resultant force in effect at a given moment in time. The length of the vector represents the magnitude of the resultant force in two dimensions. The two contributing dimensions depends upon the selected view. There are three options: sagittal (side view; Fz vs Fy), frontal (front view; Fz vs. Fx), and transverse (top view; Fy vs Fx). The desired view can be selected with the Format option and it is reported in the banner of the

display window. For example, the banner in the display shown earlier in Figure J-16 reads: **Position - L. Sagittal View** meaning that it is a position graph displaying data obtained from the left force plate viewed from the sagittal plane.

In position graphs the x axis is scaled in the length units you selected in the force plate Setup window. Available options are millimeters, centimeters, or meters. The zero point is the center of the force plate in the selected viewing plane. The origin of each vector (i.e., the lowest point in each vector) represents the calculated location of the center of pressure in that viewing plane.

The y axis is always scaled in the force units you selected in the force plate Setup window. Available options are newtons, kilograms and pounds. The force = 0 point is indicated by the small arrowhead just outside the left edge of the display box. Its position can be readily adjusted as described in the last section of the present topic. The force component that is plotted along the y axis depends upon the view. In the sagittal and frontal views, Fz is plotted along the y axis. In the transverse view it is Fy.

As was already mentioned, each vector represents the resultant of the forces in two separate dimensions. One component force is plotted on the y axis, and the y axis is scaled accordingly. The other component force is plotted on the x axis. But recall that the x axis is scaled according to the position of the center of pressure, and not in terms of force magnitude. The magnitude of the force component plotted on the x axis must therefore be inferred from the angle of the vector according to the following relation: ***x = y/tan A***, where **x** is the magnitude of the force component "plotted" on the x axis, **y** is the magnitude of the force component plotted on the y axis, and **A** is the angle of the resultant vector (vertical is assumed to be 90 degrees). For example, in a position graph viewed from the sagittal plane the relation can be expressed as ***Fy = Fz/tan A***. Thus, if the vector is angled at 45 degrees (tan A = 1), then Fy = Fz.

The relation, ***x = y/tan A*** assumes ideal conditions. There are two ways in which conditions may differ from ideal. The first has to do with the actual dimensions of a pixel. Specifically, it is always assumed that a pixel is as high as it is wide. But that may not be true for every specific monitor. However, it is probably the case that the degree of in accurace will be negligible in most cases. The second source of inaccuracy is a deviation you can intentionally introduce -- adjust the **Pitch** parameter. The Pitch parameter, accessed through the Format option, determines the ratio between what is considered a "measurement unit" in the x and y dimensions. When the Pitch is 1, then tan A = y/x (and thus x = y/tan A). When the Pitch is 2, then tan A = y/2x (and thus x = y/2 * tan A), and so on. Said qualitatively, the larger the Pitch value, the more the vectors will deviate from 90 degrees. This is useful when the force component in the y dimension is much larger than the force component in the x dimension. A frontal view, where Fz is plotted on the Y axis and Fx is (indirectly) plotted on the X axis, is a frequent example of when this situation occurs. By increasing the Pitch value you can make variations in the Fx component easier to see.

J-5.2. Hot Spots Available in 2-D Position Graph Displays

Scrolling: Move the display to a different region of the data file by interacting with the scroll bar built into the bottom edge of the display window. If you want to start the display at a specific value, position the mouse pointer on the starting time value reported above the top left corner of the display box, hold down the ALT key, then click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Display** tab, and highlights the display **Starting Time** value so that it may be easily changed.

Align (Position) the Plot: The force = 0 zero reference point associated with the plot is indicated with an arrowhead just outside the left border of the display box. To adjust the position of the plot, hold down the shift key on the keyboard, move the mouse pointer onto the arrowhead, then hold down the left mouse button as you move the mouse. A line appears in the display to indicate the position of the zero reference point as you move it.

Adjust Duration: The duration of the display is indicated above the top edge of the display box in the center. To change the duration, place the tip of the mouse pointer on the current duration value, hold down the CTRL key, then click the left or right mouse button to respectively increase or decrease the current value by a factor of two each time. To achieve a more finely tuned adjustment, place the tip of the mouse pointer on the current duration value, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option and highlights the display **Duration** value so that it may be easily changed.

Adjust Y-Scale Value: To adjust the Y-scale value, place the tip of the mouse pointer on the Y-Scale value reported above the right corner of the display box, hold down the CTRL key on the keyboard, and click the left or right mouse button to respectively increase or decrease the current value by a factor of two each time. To achieve a more finely tuned adjustment, place the tip of the mouse pointer on the Y-Scale value, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option and highlights the **Y-Scale** value so that it may be easily changed.

Adjust the Minimum or Maximum X-Scale Coordinates: Place the tip of the mouse pointer on the Y-Scale value reported above the right corner of the display box, hold down the CTRL key on the keyboard, and click the left or right mouse button. Doing so will respectively increase or decrease the difference between the minimum and maximum coordinates by a factor of two each time. To achieve a more finely tuned adjustment, place the tip of the mouse pointer on the current value, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option and highlights the **X Min** or **X Max**-value so that it may be easily changed. Remember that in position graphs the X axis is scaled in length units, as selected in the force plate module's Setup window.

Change the Title: Position the mouse pointer on the existing title of the display (or on the space directly below the menu bar, if no title currently exists), hold down the ALT key, and click the left mouse button. This action opens the menu bar's **Format** option and highlights the current **Title** so that it may be easily changed.

J-5.3. Formatting a 2D Vector Position Graph.

Select the **Format** option in the display window's command bar to open the Format window. An example is shown in Figure J-17.

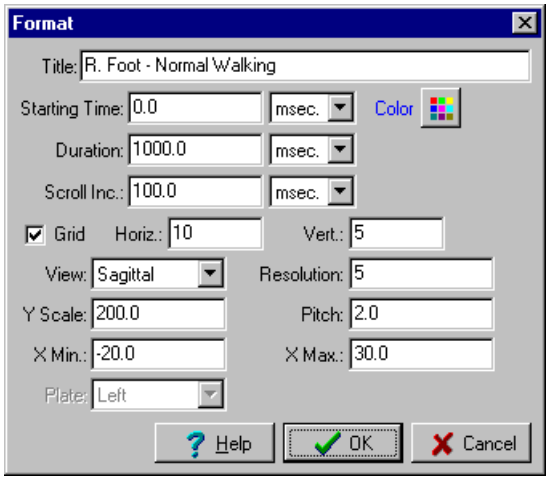


Figure J-17. An example of the Format window associated with 2-D vector position graphs.

Title: The display title is any text string that you feel best describes the contents of the display. The title appears above the display box, just to the right of the scroll bar. If you save the display parameters to a parameter file, the display title also serves as the file title, and you can use it as a long file name to retrieve the file.

Starting Time: This value indicates the starting time of the display, relative to the beginning of the data file (which is always defined as time = 0).

Color: Reports the color used to present the plot in the display (the color of the text is the color of the plot). To change the color, select the  button and select a different color from the palette window that appears.

Duration: Determines the duration of the display. The Duration parameter is actually composed of two values, represented by the two boxes. The second box determines the units of time used to interpret the value entered in the first box. The selected units are also used to report the time base value within the display itself. Note that since a time series display is always divided into ten sections by the vertical grid lines, the display's duration is always ten times the value of the time base.

Scroll Increment: Determines the interval of time that is added to, or subtracted from, the display's starting time each time you select one of the arrows on right or left edges of the scroll bar indicator presented at the top left edge of the display window. To move five times the scroll increment, select the space to either side of the button in the scroll bar.

The Scroll Increment value can be expressed in microseconds (usec), milliseconds (msec), seconds (sec), or as a percentage of the current display duration (% Dur). For example, to establish a scroll increment of 100 milliseconds, enter **100** in the left-hand box on the **Scroll Incr.** line of the Display Parameters Window, and select the **msec** option in the right-hand box. Likewise, to establish a scroll increment value equal to 50% of the display duration, enter **50** in the left-hand box and select the **% Dur** value in the right-hand box. Note that when you select the % Dur option the scroll increment changes whenever you change the display duration.

Grid, Horizontal, and Vertical: The **Grid** check box turns the display grid on and off. When the box is checked a grid of horizontal and vertical lines appears in the display. When unchecked the grid does not appear. The values entered in the **Hor[izontal]:** and **Ver[tical]:** boxes indicate the number of grid lines in each dimension.

View: This option determines the viewing angle for the display. There are three alternatives: Frontal, Sagittal, and Transverse.

Resolution: This parameter determines the ratio between the number of available data points and the number for which vectors are plotted. For example, a resolution of 1 means that a vector is plotted for each available point. A resolution of 5 means that a vector is plotted for one out of every five successive points.

Y-Scale: The Y-scale value determines the change in amplitude represented by one division on the vertical axis of the display grid. Since position graphs always display force vectors, the Y axis is scaled in the weight (force) units selected in the force plate module's Setup window.

Pitch: This value affects the angles of the vectors in the display. Values larger than 1.00 shift the angles of the vectors away from 90 degrees, thus making small differences in orientation easier to see.

X Min/X Max: These values determine the minimum and maximum coordinates of the display's X axis. In position graphs the X axis is scaled in the length units selected in the force plate module's Setup

window. In position graphs the X axis is scaled in the length units selected in the force plate module's Setup window.

Plate: When two plates are active, this option selects between the left and right plates.

J-6. 2D Vector Time Graphs

2D Vector Time Graphs are used to view forces as vectors over the duration of a trial, a portion of a trial, or over several trials. Three viewing orientations are possible: frontal, sagittal, and transverse. An example of a 2D time graph from a sagittal viewing orientation is shown in Figure J-18.

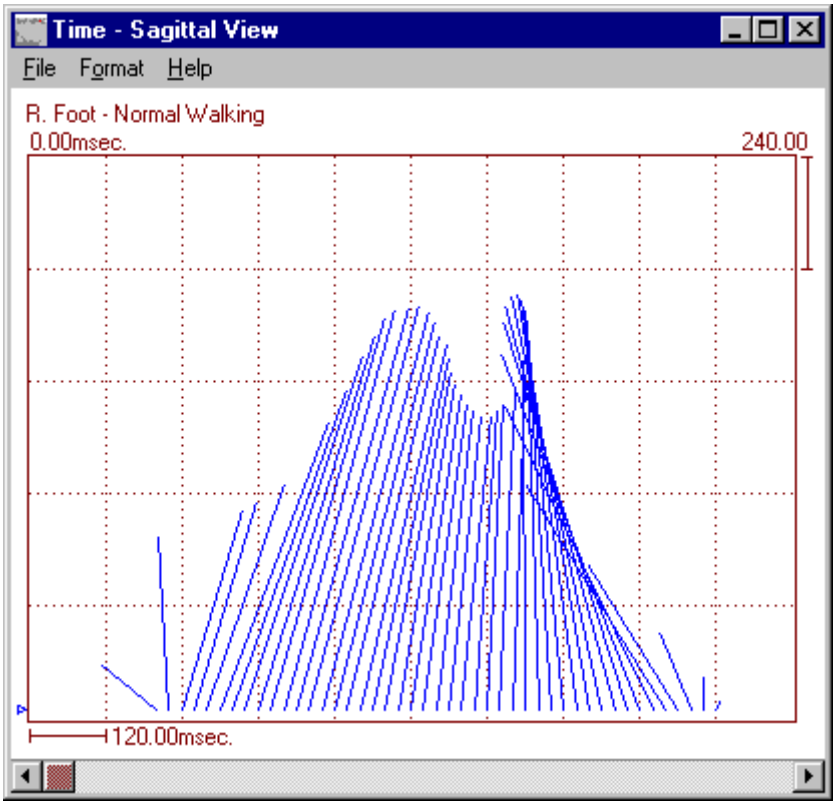


Figure J-18. An example of a 2D vector time graph (sagittal view).

When initially opened the display window employs the parameters that were in effect when the window was last closed. You can adjust the characteristics of the display by loading (retrieving) a previously saved parameter file or by using the **Format** option in the command bar at the top of the display window. Some of the display parameters can also be changed by interacting with *hot spots* on the display, as described in Section J-6.2.

J-6.1. Interpreting a 2D Vector Time Graph

Time graphs show force data as a series of vectors, with each vector representing the resultant force in effect at a given moment in time. The length of the vector represents the magnitude of the resultant force in two dimensions. The two contributing dimensions depends upon the selected view. There are three options: sagittal (side view; Fz vs Fy), frontal (front view; Fz vs. Fx), and transverse (top view; Fy vs Fx). The desired view can be selected with the Format option and it is reported in the banner of the display

window. For example, the banner in the display shown in Figure J-18 presented earlier reads: **Time - Sagittal View** meaning that it is a time graph viewed from the sagittal plane.

In time graphs the x axis is scaled in units of time as measured from the beginning of the data file. The y axis is always scaled in the force units you selected in the force plate Setup window. Available options are newtons, kilograms and pounds. The force = 0 point is indicated by the small arrowhead just outside the left edge of the display box. Its position can be readily adjusted as described in the last section of the present topic. The force component that is plotted along the y axis depends upon the view. In the sagittal and frontal views, Fz is plotted along the y axis. In the transverse view it is Fy.

As was already mentioned, each vector represents the resultant of the forces in two separate dimensions. One component force is plotted on the y axis, and the y axis is scaled accordingly. The other component force is plotted on the x axis. But recall that the x axis is scaled in units of time, not in terms of force magnitude. The magnitude of the force component plotted on the x axis must therefore be inferred from the angle of the vector according to the following relation: ***x = y/tan A***, where **x** is the magnitude of the force component "plotted" on the x axis, **y** is the magnitude of the force component plotted on the y axis, and **A** is the angle of the resultant vector (vertical is assumed to be 90 degrees). For example, in a time graph viewed from the sagittal plane the relation can be expressed as ***Fy = Fz/tan A***. Thus, if the vector is angled at 45 degrees (tan A = 1), then Fy = Fz.

The relation, ***x = y/tan A*** assumes ideal conditions. There are two ways in which conditions may differ from ideal. The first has to do with the actual dimensions of a pixel. Specifically, it is always assumed that a pixel is as high as it is wide. But that may not be true for every specific monitor. However, it is probably the case that the degree of in accurace will be negligible in most cases. The second source of inaccuracy is a deviation you can intentionally introduce -- adjust the **Pitch** parameter. The Pitch parameter, accessed through the Format option, determines the ratio between what is considered a "measurement unit" in the x and y dimensions. When the Pitch is 1, then tan A = y/x (and thus x = y/tan A). When the Pitch is 2, then tan A = y/2x (and thus x = y/2 * tan A), and so on. Said qualitatively, the larger the Pitch value, the more the vectors will deviate from 90 degrees. This is useful when the force component in the y dimension is much larger than the force component in the x dimension. A frontal view, where Fz is plotted on the Y axis and Fx is (indirectly) plotted on the X axis, is a frequent example of when this situation occurs. By increasing the Pitch value you can make variations in the Fx component easier to see.

J-6.2. Hot Spots Available in 2-D Time Graph Displays.

Scrolling: Move the display to a different region of the data file by interacting with the scroll bar built into the bottom border of the display window. If you want to start the display at a specific value, position the mouse pointer on the starting time value reported above the top left corner of the display box, hold down the ALT key, then click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Display** tab, and highlights the display **Starting Time** value so that it may be easily changed.

Align (Position) the Plot: The amplitude = 0 zero reference point associated with the plot is indicated with an arrowhead just outside the left border of the display box. To adjust the position of the plot, move the tip of the mouse pointer onto the arrowhead, hold down the shift key on the keyboard, then hold down the left mouse button as you move the mouse. A line appears in the display to indicate the position of the zero reference point as you move it.

Adjust Duration: The duration of the display is indicated above the top edge of the display box in the center. To change the duration, place the tip of the mouse pointer on the current duration value, hold down the CTRL key, then click the left or right mouse button to respectively increase or decrease the current value by a factor of two each time. To achieve a more finely tuned adjustment, place the tip of

the mouse pointer on the current duration value, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Display** tab, and highlights the display **Duration** value so that it may be easily changed.

Adjust Y-Scale Value: To adjust the Y-scale value, place the tip of the mouse pointer on the Y-Scale value reported above the right corner of the display box, hold down the CTRL key on the keyboard, and click the left or right mouse button to respectively increase or decrease the current value by a factor of two each time. To achieve a more finely tuned adjustment, place the tip of the mouse pointer on the Y-Scale value, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option, automatically selects the **Display** tab, and highlights the **Y-Scale** value so that it may be easily changed.

Adjust the Adjust Time Base: Place the tip of the mouse pointer on the current time base value reported below the bottom left corner of the display box, hold down the CTRL key on the keyboard, and click the left or right mouse button, respectively, to increase or decrease the value by a factor of two. To achieve a more finely tuned adjustment, place the tip of the mouse pointer on the current value, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option and highlights the **Duration** value so that it may be easily changed.

Change the Title: Position the mouse pointer on the existing title of the display (or on the space directly below the menu bar, if no title currently exists), hold down the ALT key, and click the left mouse button. This action opens the menu bar's **Format** option and highlights the current **Title** so that it may be easily changed.

Adjust Display Duration: Position the mouse pointer on the X-scale value reported below the bottom left corner of the *display box*, then press the left mouse button to double the display duration or press the right button to decrease it by one half. See also the Adjust X Scale paragraph, presented below.

Align Zero Amplitude Reference: The small arrowhead outside the left edge of the display box indicates the amplitude = 0 reference level. To reposition the level, move the mouse pointer on top of the arrowhead and hold down the left mouse button as you move the mouse. As you do so a horizontal line appears in the display box to monitor the zero reference level as you move it. Release the left mouse button when the horizontal line is at the desired level.

Adjust Y-Scale: Move the mouse pointer over the Y-Scale value reported above the right corner of the display box and double-click the left mouse button (to reduce the value by one half) or double-click the right mouse button (to double the value).

Adjust X-Scale: Move the mouse pointer into the display box and double-click the left mouse button to double the X-Scale value, or double-click the right mouse button (to reduce the value by one-half). Before double-clicking, be careful where you position the mouse pointer because ***the position of the mouse pointer becomes the new center point of the display***.

J-6.3. Formatting a 2D Vector Time Graph.

Select the **Format** option in the display window's command bar to open the Format window. An example is shown in Figure J-19.

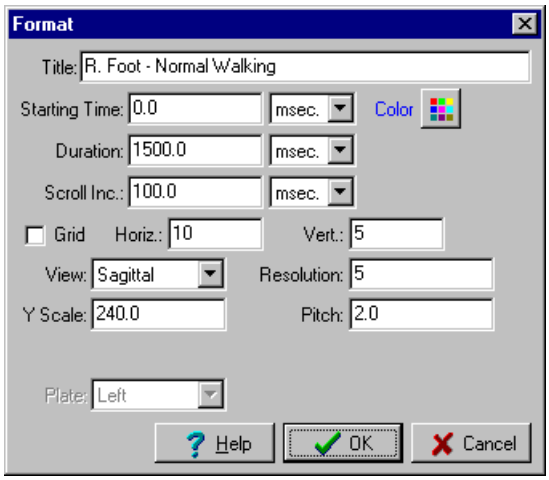


Figure J-19. An example of the display parameters window associated with 2D vector time graphs.

Title: The display title is any text string that you feel best describes the contents of the display. The title appears above the display box, just to the right of the scroll bar. If you save the display parameters to a parameter file, the display title also serves as the file title, and you can use it as a long file name to retrieve the file.

Starting Time: This value indicates the starting time of the display, relative to the beginning of the data file (which is always defined as time = 0).

Color: Reports the color used to present the plot in the display (the color of the text is the color of the plot). To change the color, select the button and select a different color from the palette window that appears.

Duration: Determines the duration of the display. The Duration parameter is actually composed of two values, represented by the two boxes. The second box determines the units of time used to interpret the value entered in the first box. The selected units are also used to report the time base value within the display itself. Note that since a time series display is always divided into ten sections by the vertical grid lines, the display's duration is always ten times the value of the time base.

Scroll Increment: Determines the interval of time that is added to, or subtracted from, the display's starting time each time you select one of the arrows on right or left edges of the scroll bar indicator presented at the top left edge of the display window. To move five times the scroll increment, select the space to either side of the button in the scroll bar.

The Scroll Increment value can be expressed in microseconds (usec), milliseconds (msec), seconds (sec), or as a percentage of the current display duration (% Dur). For example, to establish a scroll increment of 100 milliseconds, enter **100** in the left-hand box on the **Scroll Incr.** line of the Display Parameters Window, and select the **msec** option in the right-hand box. Likewise, to establish a scroll increment value equal to 50% of the display duration, enter **50** in the left-hand box and select the **% Dur** value in the right-hand box. Note that when you select the % Dur option the scroll increment changes whenever you change the display duration.

Grid, Horizontal, and Vertical: The **Grid** check box turns the display grid on and off. When the box is checked a grid of horizontal and vertical lines appears in the display. When unchecked the grid does not appear. The values entered in the **Hor[izontal]:** and **Ver[tical]:** boxes indicate the number of grid lines in each dimension.

View: This option determines the viewing angle for the display. There are three alternatives: Frontal, Sagittal, and Transverse.

Resolution: This parameter determines the ratio between the number of available data points and the number for which vectors are plotted. For example, a resolution of 1 means that a vector is plotted for each available point. A resolution of 5 means that a vector is plotted for one out of every five successive points.

Y-Scale: The Y-scale value determines the change in amplitude represented by one division on the vertical axis of the display grid. Since position graphs always display force vectors, the Y axis is scaled in the weight (force) units selected in the force plate module's Setup window.

Pitch: This value affects the angles of the vectors in the display. Values larger than 1.00 shift the angles of the vectors away from 90 degrees, thus making small differences in orientation easier to see.

Plate: When two plates are active, this option selects between the left and right plates.

J-7. 2D Vector Point Graphs.

2D Vector Point Graphs are used to view forces as vectors arising from a single point in space. Three viewing orientations are possible: frontal, sagittal, and transverse. An example of a 2D point graph from a sagittal viewing orientation is shown in Figure J-20.

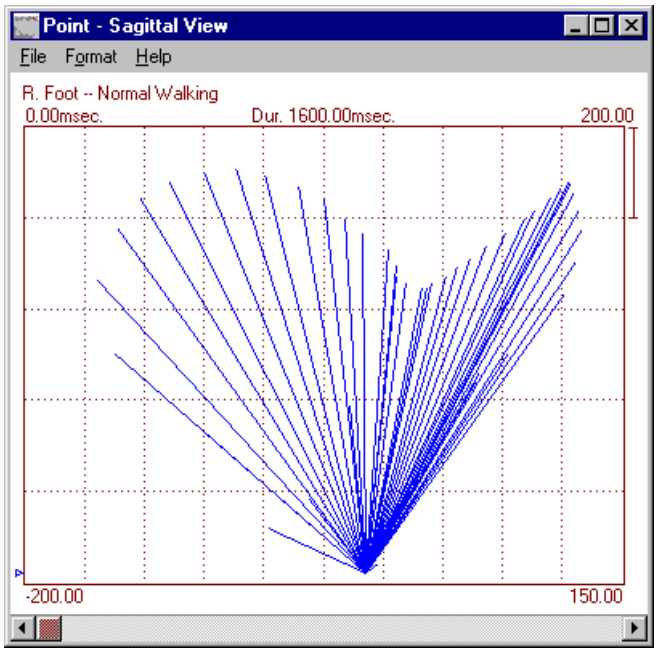


Figure J-20. An example of a 2D Vector Point Graph display (sagittal view).

When initially opened the display window employs the parameters that were in effect when the window was last closed. You can adjust the characteristics of the display by loading a previously saved parameter file or by using the **Format** option in the command bar at the top of the display window. Some of the display parameters can also be changed by interacting with *hot spots* on the display, as described in Section J-7.2.

J-7.1. Interpreting a 2D Vector Point Graph

Point graphs show force data as a series of vectors, with each vector representing the resultant force in effect at a given moment in time. The length of the vector represents the magnitude of the resultant force in two dimensions. The two contributing dimensions depends upon the selected view. There are three options: sagittal (side view; Fz vs Fy), frontal (front view; Fz vs. Fx), and transverse (top view; Fy vs Fx). The desired view can be selected with the Format option and it is reported in the banner of the display window. For example, the banner in the dsplay shown previously in Figure J-20 reads: **Point - Sagittal View** meaning that it is a point graph displaying force data viewed from the sagittal plane.

Unlike position and time graphs, both the x and y axes are scaled in the force units you selected in the force plate Setup window. Available options are newtons, kilograms and pounds. In the y axis the force = 0 point is indicated by the small arrowhead just outside the left edge of the display box. Its position can be readily adjusted by interacting with the zero reference indicator's hot spot, as described in the next section. The force component that is plotted along the y axis depends upon the view. In the sagittal and frontal views, Fz is plotted along the y axis. In the transverse view it is Fy. The coordinates of the x-axis are established more directly by adjusting the minimum and maximum values. This can be done by interacting with the appropriate hot spots, as described in the next section, or by selecting the Format option in the display window's menu bar.

J-7.2. Hot Spots Available in 2-D Point Graph Displays.

Scrolling: Move the display to a different region of the data file by interacting with the scroll bar built into the bottom border of the display window. If you want to start the display at a specific value, position the mouse pointer on the starting time value reported above the top left corner of the display box, hold down the ALT key, then click the left mouse button. This action opens the menu bar's **Format** optionand highlights the display **Starting Time** value so that it may be easily changed.

Align (Position) the Plot: The force = 0 zero reference point associated with the plot is indicated with an arrowhead just outside the left border of the display box. To adjust the position of the plot, hold down the shift key on the keyboard, move the mouse pointer onto the arrowhead, then hold down the left mouse button as you move the mouse. A line appears in the display to indicate the position of the zero reference point as you move it.

Adjust Duration: The duration of the display is indicated above the top edge of the display box in the center. To change the duration, place the tip of the mouse pointer on the current duration value, hold down the CTRL key, then click the left or right mouse button to respectively increase or decrease the current value by a factor of two each time. To achieve a more finely tuned adjustment, place the tip of the mouse pointer on the current duration value, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option and highlights the display **Duration** value so that it may be easily changed.

Adjust Y-Scale Value: To adjust the Y-scale value, place the tip of the mouse pointer on the Y-Scale value reported above the right corner of the display box, hold down the CTRL key on the keyboard,

and click the left or right mouse button to respectively increase or decrease the current value by a factor of two each time. To achieve a more finely tuned adjustment, place the tip of the mouse pointer on the Y-Scale value, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option and highlights the **Y-Scale** value so that it may be easily changed.

Adjust the Minimum or Maximum X-Scale Coordinates: Place the tip of the mouse pointer on the Y-Scale value reported above the right corner of the display box, hold down the CTRL key on the keyboard, and click the left or right mouse button. Doing so will respectively increase or decrease the difference between the minimum and maximum coordinates by a factor of two each time. To achieve a more finely tuned adjustment, place the tip of the mouse pointer on the current value, hold down the ALT key and click the left mouse button. This action opens the menu bar's **Format** option and highlights the **X Min** or **X Max**-value so that it may be easily changed. Remember that in position graphs the X axis is scaled in length units, as selected in the force plate module's Setup window.

Change the Title: Position the mouse pointer on the existing title of the display (or on the space directly below the menu bar, if no title currently exists), hold down the ALT key, and click the left mouse button. This action opens the menu bar's **Format** option and highlights the current **Title** so that it may be easily changed.

J-7.3. Formatting a 2D Vector Point Graph.

Select the **Format** option in the display window's command bar to open the Format window. An example is shown in Figure J-21.

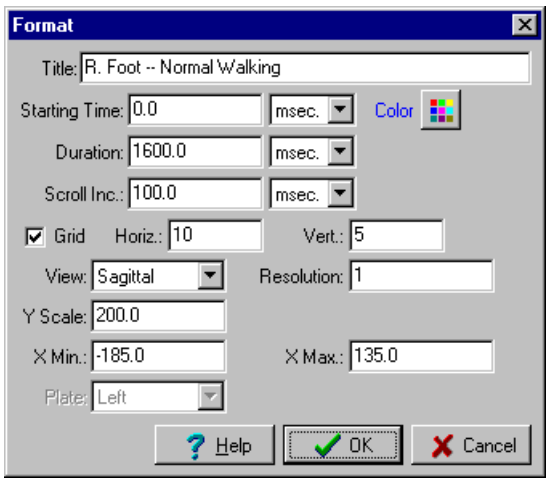


Figure J-21. An example of the Format window associated with a 2D vector point graph.

Title: The display title is any text string that you feel best describes the contents of the display. The title appears above the display box, just to the right of the scroll bar. If you save the display parameters to a parameter file, the display title also serves as the file title, and you can use it as a long file name to retrieve the file.

Starting Time: This value indicates the starting time of the display, relative to the beginning of the data file (which is always defined as time = 0).

Color: Reports the color used to present the plot in the display (the color of the text is the color of the plot). To change the color, select the  button and select a different color from the palette window that appears.

Duration: Determines the duration of the display. The Duration parameter is actually composed of two values, represented by the two boxes. The second box determines the units of time used to interpret the value entered in the first box. The selected units are also used to report the time base value within the display itself. Note that since a time series display is always divided into ten sections by the vertical grid lines, the display's duration is always ten times the value of the time base.

Scroll Increment: Determines the interval of time that is added to, or subtracted from, the display's starting time each time you select one of the arrows on right or left edges of the scroll bar indicator presented at the top left edge of the display window. To move five times the scroll increment, select the space to either side of the button in the scroll bar.

The Scroll Increment value can be expressed in microseconds (usec), milliseconds (msec), seconds (sec), or as a percentage of the current display duration (% Dur). For example, to establish a scroll increment of 100 milliseconds, enter **100** in the left-hand box on the **Scroll Incr.** line of the Display Parameters Window, and select the **msec** option in the right-hand box. Likewise, to establish a scroll increment value equal to 50% of the display duration, enter **50** in the left-hand box and select the **% Dur** value in the right-hand box. Note that when you select the % Dur option the scroll increment changes whenever you change the display duration.

Grid, Horizontal, and Vertical: The **Grid** check box turns the display grid on and off. When the box is checked a grid of horizontal and vertical lines appears in the display. When unchecked the grid does not appear. The values entered in the **Hor[izontal]:** and **Ver[tical]:** boxes indicate the number of grid lines in each dimension.

View: This option determines the viewing angle for the display. There are three alternatives: Frontal, Sagittal, and Transverse.

Resolution: This parameter determines the ratio between the number of available data points and the number for which vectors are plotted. For example, a resolution of 1 means that a vector is plotted for each available point. A resolution of 5 means that a vector is plotted for one out of every five successive points.

Y-Scale: The Y-scale value determines the change in amplitude represented by one division on the vertical axis of the display grid. Since position graphs always display force vectors, the Y axis is scaled in the weight (force) units selected in the force plate module's Setup window.

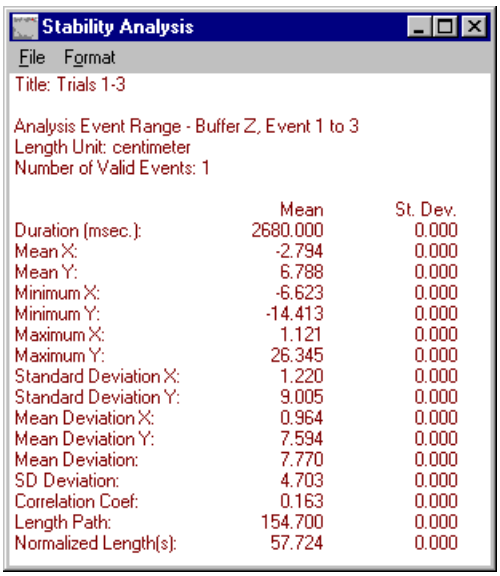
Pitch: This value affects the angles of the vectors in the display. Values larger than 1.00 shift the angles of the vectors away from 90 degrees, thus making small differences in orientation easier to see.

X Min/X Max: These values determine the minimum and maximum coordinates of the display's X axis. In position graphs the X axis is scaled in the length units selected in the force plate module's Setup window. In point graphs both the x and y axes are scaled in the force units selected in the force plate module's Setup window.

Plate: When two plates are active, this option selects between the left and right plates.

J-8. Stability Analysis

The Force Plate module's stability analysis feature is designed to examine variations in center of pressure measurements over time and to present the results in the form of a table. An example is shown in Figure J-22. A stability analysis can be performed on the entire data file, any single segment of the file, or on multiple segments that have been defined as events. Use the Format option to select the segment you wish to analyze.



	Mean	St. Dev.
Duration (msec.):	2680.000	0.000
Mean X:	-2.794	0.000
Mean Y:	6.788	0.000
Minimum X:	-6.623	0.000
Minimum Y:	-14.413	0.000
Maximum X:	1.121	0.000
Maximum Y:	26.345	0.000
Standard Deviation X:	1.220	0.000
Standard Deviation Y:	9.005	0.000
Mean Deviation X:	0.964	0.000
Mean Deviation Y:	7.594	0.000
Mean Deviation:	7.770	0.000
SD Deviation:	4.703	0.000
Correlation Coef:	0.163	0.000
Length Path:	154.700	0.000
Normalized Length(s):	57.724	0.000

Figure J-22. An example of the Stability Analysis table.

It is important to recognize that the table always reports two columns of values labeled as "Mean" and "St. Dev.". However, when a single segment is analyzed only one value is obtained for each type of measurement. Consequently, the "Mean" column reports the value obtained for an N of 1. Under such conditions the reported standard deviation will always be 0.000. When multiple segments are analyzed, however, a value is obtained for each segment, then a mean and standard deviation is obtained for each type of measure across segments. These are the means and standard deviations that are reported in the table.

The items reported in the stability analysis table are described below:

Title: A text string that you can use to describe the contents of the table. Use the Format option to insert, remove, or change the title.

Analysis Event Range: Reports the parameters of the Analysis Region you selected in the Format window

Length Unit: Reports the length unit selected in the force plate module's Setup window.

Number of Valid Events: the number of segments you elected to analyze in your data file. If you elected to analze the entire file the number will be one.

Duration: the average duration of the analyzed segment in each "defined event" (as described above). If the Threshold option is off in the Analysis parameters window (accessible by selecting the Analysis

button in Force Plate analysis parameters window) the duration of a segment will be equal to the duration of the corresponding event. If the Threshold option is on, however, the duration of a segment is reduced by the amount of time the force in the Z axis remains below threshold.

Mean X, Mean Y: Mean center of pressure measured in either the X (lateral) or Y (antero-posterior) dimensions. If there is more than one event in your analysis then the value reported is the mean of the values obtained for each event. The unit of measure is whatever you defined the Length Unit to be in the force plate module's Setup window.

Minimum/Maximum X/Y: The minimum and maximum values of the point-by-point calculated center of pressure in either the X or Y dimensions. If there is more than one event in your analysis then the value reported is the mean of the values obtained for each event. The unit of measure is whatever you defined the Length Unit to be in the force plate module's Setup window.

Mean Deviation X, Y, both: The mean deviation from the calculated "center point" for each event; i.e., the point represented by the obtained Mean X and Mean Y values. The Mean Deviation X value represents the average deviation in the X axis, the Mean Deviation Y value in the Y direction, and the Mean Deviation value in both the X and Y combined -- i.e., it calculates the average length of the diagonal or hypotenuse from each COP point to the center point, as expressed by the formula, sqrt(x**2 + y**2) where x and y are the differences between the center point and the point in question in each respective dimension. If there is more than one event in your analysis then the value reported is the mean of the values obtained for each event. The unit of measure is whatever you defined the Length Unit to be in the force plate module's Setup window. Deviation values are always positive regardless of direction, so these are measures of average variability about the center point.

Correlation Coeff: A measure of the strength of the relationship between variations in Y relative to X.

Length of Path: A measure of the cumulative "distance" travelled by the center of pressure over the entire duration of the analyzed portion of each event (i.e., as Duration was defined above). The formula is Length of Path = sum(sqrt((x2-x1)**2 + (y2-y1)**2)). If there is more than one event in your analysis then the value reported is the mean of the values obtained for each event. The unit of measure is whatever you defined the Length Unit to be in the force plate module's Setup window.

Normalized Length: Length of Path normalized to a duration of one second.

J-8.1. Formatting a Stability Analysis

Formatting a stabiilty analysis is a simple matter of specifying which plate will contribute the data (if two plates are in use), and which segment or segments of the data file will be analyzed. You can also insert a **Title** to appear in the table as well, but that is optional. An example of the Format window associated with the stability analysis table display is shown in Figure J-23.

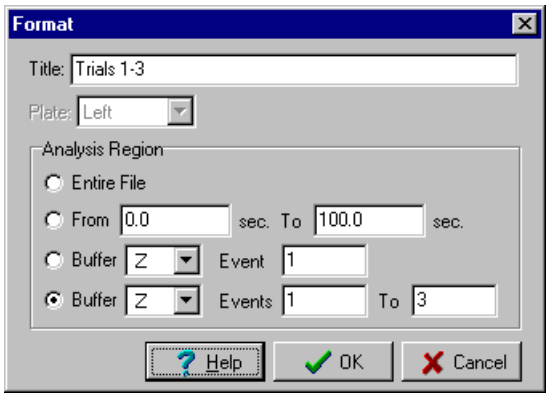


Figure J-23. The Format window associated with the Stability Analysis.

Selecting the Segment or Segments of the Data File to Analyze:

Use the **Analysis Region** section of the Format window to select the segment or segments of the data file you wish to analyze. There are four options, as described below:

Entire File: Analyze the entire data file as one continuous segment.

Singe Segment (From/To): Analyze a single segment of the data file, starting and ending at the times indicated. Time is measured from the beginning of the data file in physical time coordinates.

Single Event (Buffer/Event): Analyze a single segment that has been defined as the specified **Event** in the specified **[Event] Buffer**. Recall that when a data file is acquired with the Data Acquisition module, a record is maintained of each segment of acquired data in the form of an event in event buffer Z. For example, if a data files is composed of several trials or sweeps of data collected at different times, each trial or sweep is defined as an event in buffer Z. Therefore, you can use the Single Event option to perform a stability analysis on an individual trial.

Multiple Events (Buffer/Events): Analyze multiple segments wherein each segment had been defined as an event in a specified **[Event] Buffer**. Be sure to specify the proper sequence of events in the supplied boxes. When analyzing multiple events, each event is analyzed separately and a composite average is obtained. It is the composite average, rather than the results of individual segments, that is reported in the table. The standard deviation of each obtained mean is also reported.

☞ It is important to recognize that the stability analysis table always reports two columns of values labeled as "Mean" and "St. Dev.". However, when a single segment is analyzed only one value is obtained for each type of measurement. Consequently, the "Mean" column reports the value obtained for an N of 1. Under such conditions the reported standard deviation will always be 0.000. When multiple segments are analyzed, however, a value is obtained for each segment, then a mean and standard deviation is obtained for each type of measure across segments. These are the means and standard deviations that are reported in the table.