SigmaPlot User Guide

Contents

Chapter 1. Welcome to SigmaPlot!

SigmaPlot makes it easier for you to present your findings accurately using precise, publication-quality graphs, data analysis and presentation tools.

SigmaPlot offers numerous scientific options such as automatic error bars, regression lines, confidence intervals, axis breaks, technical axis scales, nonlinear curve fitting, and a data worksheet for powerful data handling.

SigmaPlot is a state-of-the-art technical graphing program designed for the Windows platform. It is certified for Microsoft Office 2003-2016, Windows Vista, Windows 7, Windows 8 and 8.1 and Windows 10. SigmaPlot is specifically designed to aid in documenting and publishing research, specializing in the graphical presentation of results.

Creating and editing graphs is easy. Just click the **Create Graph** tab, select a graph type, pick your data with the Graph Wizard, and you can create a graph in seconds. You can create a formatted worksheet, or use templates or the Graph Style Gallery to apply favorite graph styles again and again.

SigmaPlot also includes a powerful nonlinear curve fitter, a huge scientific data worksheet that accommodates large data sets, summary statistics including SigmaStat's entire test collection, a mathematical transform language, and much more.

OLE2 technology is fully supported. You can annotate graphs with the Microsoft Word Equation Editor, edit your graphs directly inside Word or PowerPoint, or plot your data with an Excel spreadsheet right inside SigmaPlot.

You can annotate graphs with the Microsoft Word Equation Editor, edit your graphs directly inside Word or PowerPoint, or plot your data with an Excel spreadsheet right inside SigmaPlot.

SigmaStat *(on page)* provides a wide range of powerful yet easy-to-use statistical analyses specifically designed to meet the needs of research scientists, engineers, students, and statisticians, without requiring in-depth knowledge of the math behind the procedures performed.

Installing SigmaPlot

Install SigmaPloton your computer from the CD. The installation program automatically starts up when the CD is placed in the CD-ROM drive. The dialog boxes that guide you through the installation process are simple and self-explanatory.

Important:
In order to accomplish your installation, you will need to have your product registration number available.

System Requirements

Software

- Windows 7, Windows 8.x, Windows 10
- Internet Explorer Version 8 or better
- Office 2003 or higher

Hardware

- 2 GHz 32-bit (x86) or 64-bit (x64) Processor
- 2 GB of System Memory for 32-bit (x86)
- 4 GB of System Memory for 64-bit (x64)
- 200 MB of Available Hard Disk Space

All Operating Systems: 800x600 SVGA/256 color display or better.

Serial Numbers

Your unique serial number is located on the CD cover. Have this number available when you call for product support, payment, or system upgrade. Copy this number to the registration card and send it in to Systat Software, Inc.

Registration entitles you to:

- Unlimited technical support.
- Product upgrades.

Uninstalling SigmaPlot

To uninstall SigmaPlot:

1. From the **Start** menu, right-click the version of SigmaPlot you'd like to remove and then click **Uninstall**.
   The **Programs and Features** dialog box appears.
2. Select SigmaPlot from the list and follow the rest of the instructions.

About SigmaPlot's User and Program Files

SigmaPlot is installed for all users that have user accounts on a machine. It installs its program files into a *Program Folder* - these are necessary for the program to run - and then creates files in *User Folders* for each user on a machine.

This means that two or more separate users can share SigmaPlot using his or her own set of SigmaPlot files and settings. When someone uses SigmaPlot for the first time, it creates a *User Folder* just for that person. In this way, many people can use the same version of SigmaPlot without risking damage to others' files.

SigmaPlot's User Files

When SigmaPlot starts, it checks to see if a user folder exists for the current user. The User Folder is in `C:\Documents and Settings\user\My Documents\SigmaPlot\SPW15`.

If the User Folder does not exist, SigmaPlot creates the folder and copies user files from the Program Files folder to the User Folder. The user files for SigmaPlot include:

- **Submission Profiles.** This directory contains all the available submission profile .ini files.
- **Samples.** This directory contains samples files of data and graphs that illustrate the capabilities of SigmaPlot’s graphing, statistical tests, and macros.
- **Gallery.jgg.** This is the Graph Gallery *(on page 87)* file including any user-defined graph styles.
- **GraphWzd.ini.** This file stores all Graph Wizard *(on page 75)* settings.
- **HistogramWzd.ini.** This file stores histogram settings. For more information, see Creating Histograms *(on page)*.
- **DemingWzd.ini.** This file stores Deming Regression Wizard settings. For more information, see Deming Regression *(on page)*.
- **Layout.jnt.** This notebook file is the layout file used when formatting or arranging graphs *(on page 179)*.
- **SigmaPlot Macro Library.jnb.** This notebook file contains the Standard Macro Library and user-defined macros *(on page 402)*.

- **SPW.ini.** This file stores all SigmaPlot user's settings.
- **Stat32.ini.** This file stores all SigmaStat user's settings.
- **Standard.jfl.** This Standard Equations Library includes all user-defined equations *(on page)*.
- **Template.jnt.** This notebook file is where all the graph page templates *(on page 87)* are stored.
- **EK.ini.** The files stores settings used by the Enzyme Kinetics module *(on page 38)*.
- **Spw32.opt.** This file stores the option settings for all statistical tests. It is not installed, but generated after first running SigmaPlot.
- **Stat32.opt.** This file stores the option settings for all statistical tests.

Contacting Systat Software, Inc.

If you would like to be on our mailing list, contact one of our offices or distributors below. We will send you a copy of our newsletter and let you know about Systat Software, Inc. activities in your area.

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SigmaPlot's Program Files

During installation, SigmaPlot by default installs the following directories and files into `C:\Program Files\SigmaPlot\SPW15`.

The installed files include spw.exe, all the Help files, .dll files, .pdf manuals, and the following sub-folders:

- **FAQs directory.** This directory contains all the .html and graphics files used in the SigmaPlot FAQs.
- **Macro Transforms directory.** This directory contains the .xfm files used for the macros Frequency Plot, Power Spectral Density, Rank and Percentile, and Vector Plot. For more information, see SigmaPlot Tools *(on page 402)*.
- **Samples directory.** This directory includes sample graphs (graph samples.snb) data (statistics samples.snb), and nonlinear curve fit examples (NonLinReg samples.snb).
- **Submission Profiles.** This directory contains all the available submission profile .ini files. For more information, see Publishing Graphs on the World Wide Web *(on page 377)*.
- **Transforms directory.** This directory contains sample transforms. .

Automatically Updating SigmaPlot

Every time you start SigmaPlot, if there is an update available, the **Updates** tab of the **SigmaPlot License Manager** appears.

New patches appear under **Patch Updates**.

To install, select the patch name, and then click **Install Updates**.

> **Note:**
> If for whatever reasons you cannot gain access to the server, click **Retry**.

Deactivating Update Notifications

You can turn off update notifications on the **SigmaPlot 15.0 License Utility**.

1. In the upper right-hand corner of SigmaPlot, click **Sigma Help > License Status**
   The **SigmaPlot 15.0 License Utility** appears.

2. Click the **Updates** tab.
3. Clear **Always check updates on application start up**.

Updating SigmaPlot from the Start Menu

1. On your Windows Start menu, click **Start > All Programs > SigmaPlot > SigmaPlot 15.0 Update**
   The **Updates** tab of the **SigmaPlot 15.0 License Utility** appears.
2. Select the update under **Patch Updates**.
3. Click **Install Updates**.

Updating from SigmaPlot

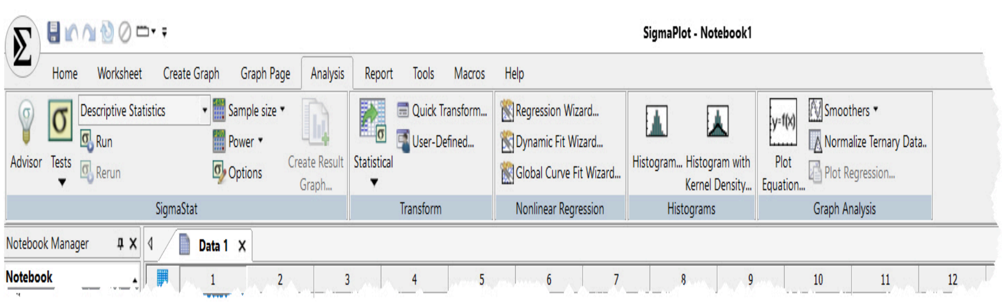
1. In the upper right-hand corner of SigmaPlot, click **Sigma Help > License Status**
   The **SigmaPlot 15.0 License Utility** appears.
2. Click the **Updates** tab.
3. Select the update under **Patch Updates**.
4. Click **Install Updates**.

SigmaPlot Basics

SigmaPlot runs under the Windows operating system and functions within the standard Windows interface. For information on how Windows works, refer to your Windows documentation.

Using SigmaPlot's Ribbons

SigmaPlot's Ribbon is very similar to what you've seen in Microsoft Office 2007's Fluent User Interface.



The SigmaPlot Ribbon groups SigmaPlot's commands by functionality. Each tab exposes a set of task-specific controls. To see the controls, click the tab. If a worksheet is in view, you'll see the **Worksheet** tab. A graph page exposes the **Graph Page** tab.

The default setting for the SigmaPlot's Ribbon is "sticky." This means that you control which tab is in view. You can, if you like, set SigmaPlot's Ribbon to use Context Ribbon Switching (on page 27).

Customizing the SigmaPlot Ribbon

SigmaPlot comes equipped with four ribbon configurations so that, depending on your use, you can display only the tabs and groups as you need them. In this way, you can cut back on having to click between tabs; the steps within your work flow exist within that one tab.

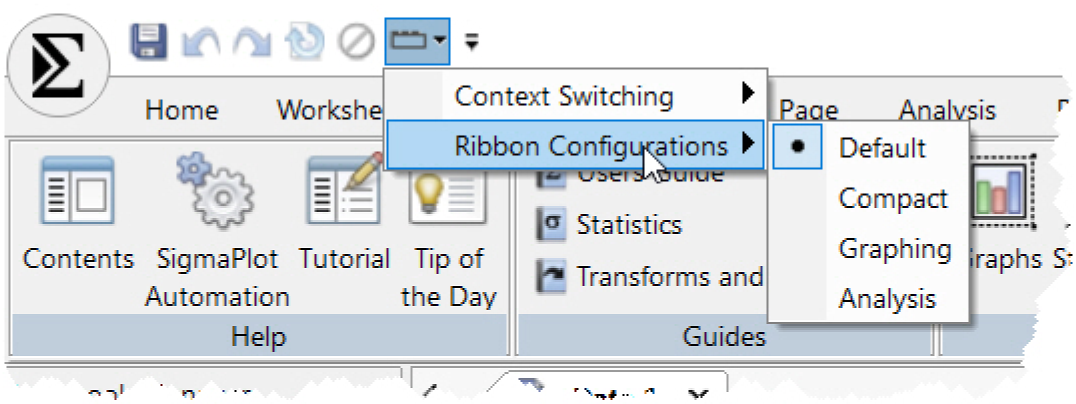
You can switch how your ribbon is configured at any time.

The four configurations are:

- **Default.** This configuration displays all of SigmaPlot's tabs and groups. Here you have complete access to all of SigmaPlot's graphing and analysis features.
- **Compact.** This configuration combines the most commonly used features for graph creation and data analysis onto the Graph tab and Worksheet tab respectively.
- **Graphing.** This is the original SigmaPlot configuration without the data analysis features.
- **Analysis.** Select this configuration if you plan on doing a lot of statistics. Its expanded selection of tests and a tab order that reflects a traditional SigmaStat work flow.

How to Customize Your Ribbon

1. Select the **Change the Ribbon Configuration** drop-down list from the Quick Access Toolbar (on page 35).



2. Select your desired ribbon configuration from the drop-down list.

Minimizing Ribbons

You can't delete Ribbons, but you can minimize them to create more work space on the SigmaPlot desktop.

1. Click **Customize Quick Access Toolbar**.
2. In the list that appears, click **Minimize the Ribbon**.

> **Tip:**
> You can also double-click any Ribbon title to temporarily minimize the Ribbon; double-click it again for it to appear.

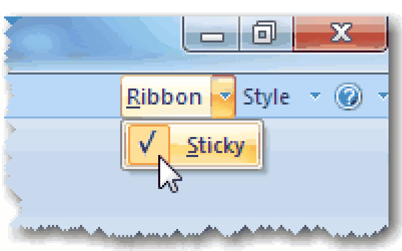
Minimizing Ribbons for a Short Period of Time

To quickly minimize a Ribbon, double-click the tab. To restore it, double-click the tab again. Alternatively, you can use the keyboard shortcut CTRL+F1 to minimize and restore the Ribbon.

Turning Off Sticky Ribbons

The SigmaPlot Ribbon by default is set to “sticky,” meaning you control which tab appears. If you want, you can set this to work more in compliance with Microsoft’s Fluent User Interface, and use what is called **Context Ribbon Switching**. This means that whatever is in view, whether it be a graph page, a worksheet, report, and so on, determines which Ribbon appears.

1. In the upper right-hand corner of SigmaPlot, click **Ribbon**.



2. Click the downward arrow, and then clear **Sticky**.

> **Note:**
> To restore this setting, follow the steps above and select **Sticky**.

Keyboard Shortcuts

In addition to the keyboard shortcuts that appear below, you can press the Alt key at any time to display keyboard shortcuts available on all the ribbons. For example, if you wanted to run the Dot Density macro, you'd press the Alt key, and then type T for Toolbox and then D for the Dot Density macro.

Table 1. General Keyboard Shortcuts

The following table describes basic keyboard shortcuts available through out SigmaPlot's worksheets, graph pages, and reports.

Press this key	To do this
Display Help (F1)	Display Help
Copy (Ctrl + C))	Copy the selected item
Cut (Ctrl + X)	Cut the selected item
Paste (Ctrl + V))	Paste the selected item
Undo (Ctrl + Z)	Undo an action
Redo (Ctrl + Y)	Redo an action
Delete (or Ctrl + D)	Delete the selected item and move it to the Recycle Bin
Bold (Ctrl + B)	Make the selected text bold.
Italic (Ctrl + I)	Italicize the selected text.
Underline (Ctrl + U)	Underline the selected text.

Table 2. Worksheet Tab Shortcuts

Press this key	To do this
Rename (F2)	Rename the selected item
Import (Ctrl + L)	Import data into the current worksheet.
Insert	Switch from inserting to overwriting data in the worksheet.
Sort (Ctrl + Shift + O)	Arrange selected data in ascending or descending order using a key column.
Insert Graphic Cells (Ctrl + Shift + C)	Insert a graph item property into the worksheet.

Table 2. Worksheet Tab Shortcuts (continued)

Press this key	To do this
Column and Row Titles (F9)	Enter column and row titles.
View Column Statistics (F6)	Display descriptive statistics of all columns containing numeric values.

Table 3. Create Graph Tab Shortcuts

Press this key	To do this
Create Graph (F3)	Open the Graph Wizard to create a graph or add a plot to an existing graph.
Ctrl + =	Move selected objects in front of all other objects so that no parts are hidden behind other objects.
Ctrl + -	Move selected objects behind all other objects.

Table 4. Graph Page Shortcuts

Press this key	To do this
Align (Ctrl + =)	Move selected objects in front of all other objects so that no parts are hidden behind other objects.
Group (Ctrl + Shift + G)	Combine objects so that they are treated as a single object.
Ctrl + Shift + U	Break apart a group.
Select Object (Ctrl + Shift + O)	Change to the standard select/move/stretch editing mode.
Text (Ctrl + T)	Place text on the graph page.
Draw Line (Ctrl + Shift + L)	Draw lines using different line patterns.
Draw Arrow (Ctrl + Shift + A)	Draw lines with arrowheads of different sizes and shapes.
Draw Box (Ctrl + Shift + B)	Draw rectangles and squares.
Draw Ellipse (Ctrl + Shift + E)	Draw ellipses and circles.

Table 5. Analysis Tab Shortcuts

Press this key	To do this
Quick Transform (Shift + F10)	Run a single line transform by selecting functions from a panel and selecting worksheet functions.
User-Defined Transform (F10)	Enter a multi-line transform for complex computations.
Nonlinear Regression (F5)	Perform a curve fit of a selected equation to points selected on a graph or data in the worksheet.

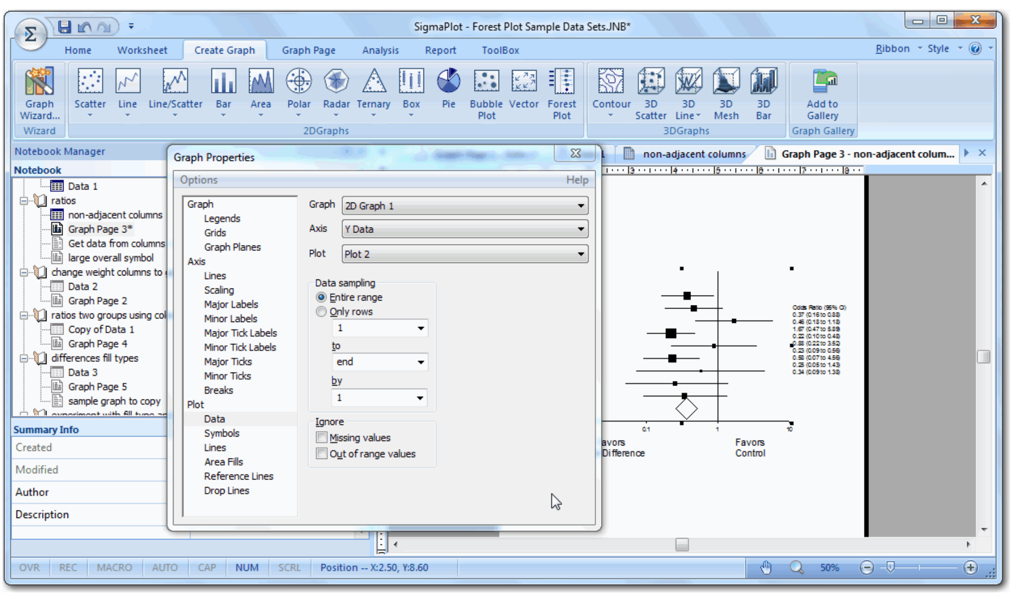
Table 6. Toolbox Tab Shortcuts

Press this key	To do this
Macros (Alt + F8)	Display macros to run, edit, change options, or delete.

Using Graph Properties

Use Graph Properties to make immediate modifications to graphs.

Figure 1. Use Graph Properties to make any graph modification.

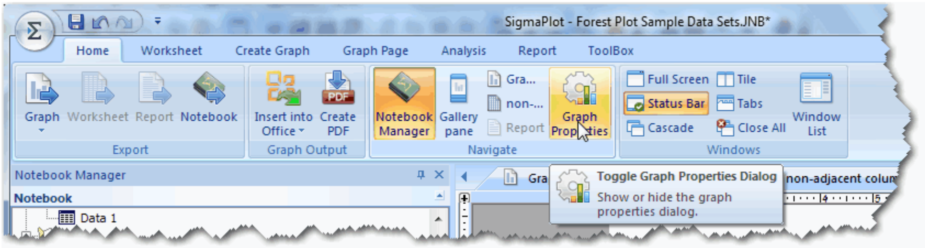


To open Graph Properties, double-click anywhere in the graph. Usually, what you double-click determines which options appear in Graph Properties. Changes immediately appear in the graph, giving you instant feedback. For more information, see Modifying Graphs Using Graph Properties *(on page 89)*.

Alternatively, you can:

1. Click the **Home** tab.
2. In the **Navigate** group, click **Graph Properties**.

Figure 2. You can toggle Graph Properties “on” and “off,” much like the Notebook Manager and the Graph Style Gallery.



Getting Help in Graph Properties

In the right-hand corner of the **Graph Properties** dialog box, click **Help**.

Tip:

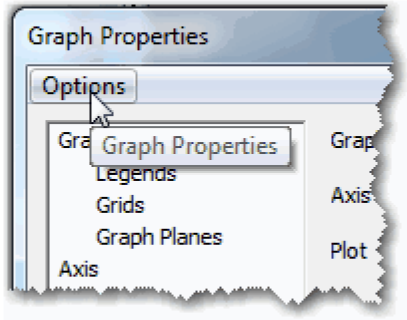
You can also press F1 at any time.

Turning Off Graph Properties Transparency

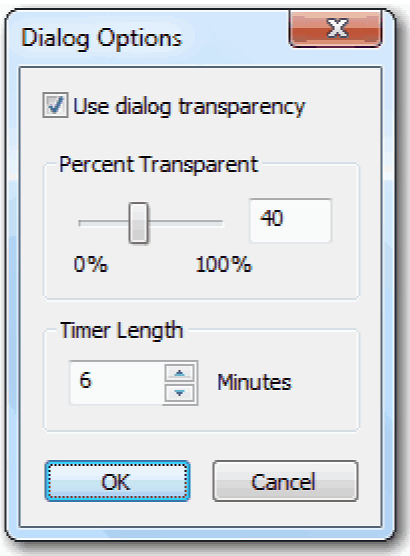
Graph Properties is by default set to be transparent so that when you move the pointer away from it, you can see your graph without having to close the dialog box. You can certainly turn this feature off.

To turn off Graph Properties transparency:

1. Click **Options** in the upper left-hand corner of **Graph Properties**.



2. **To turn off Graph Properties transparency outright**, clear **Use dialog transparency**.



3. **To change Graph Properties transparency to a different percentage,** move the **Percent Transparent** slider or enter a percentage in its edit box.

Main Button

Whenever you need to save, print, or open a file, click the **Main Button**.

Setting Program Options

Use SigmaPlot's program options to control application settings, as well as how worksheets and new pages and graphs appear. To change program options:

1. Click the **Main Button**  and then click **Options**.
   The **Options** dialog box appears.

2. Choose the appropriate tab and make changes.
    - **Worksheet.** Worksheet options include settings for numbers, statistics, date and time, worksheet display, default column width, number of decimal places, and use of engineering notation.
    - **Page.** Page options control graph page properties.
    - **General.** The **General** tab controls application settings.
    - **Report.** Set report options, such as measurement units or to display rulers, on the **Reports** tab.
    - **Graph.** Graph defaults control attributes that are applied to all new graphs.
    - **Macro.** Select macro options, such as code colors and which macro library to use on the **Macro** tab.
3. Click **OK** to apply the changes and close the dialog box.

Graph Types and Styles

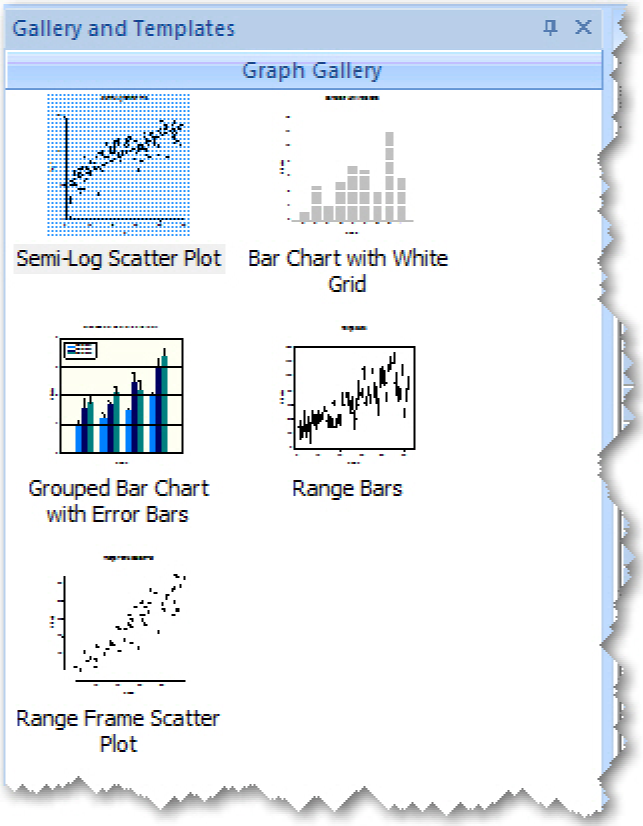
SigmaPlot's selectable *Graph Type* determines the structure of your graph. SigmaPlot provides many different types of two- and three-dimensional Cartesian (XY and XYZ) graphs, as well as pie charts and polar plots.

Graph Style determines how data is plotted on a graph. Available styles depend on the selected Graph Type. SigmaPlot's *Graph Wizard* conveniently displays all available graph styles associated with each graph type.

Graph Style Gallery and Templates

Use the SigmaPlot Graph Style Gallery to create and store true graph templates using any existing graph style as the model. Every graph that you add to the Graph Style Gallery is saved as a bitmap image. You can later apply this as a template for future graphs.

Figure 3. The Graph Style Gallery



Templates. The SigmaPlot template notebook contains a variety of page layouts. Apply these predetermined template attributes to previously saved pages and graphs, or create a user-defined template. Store your templates in a SigmaPlot Notebook Template file (.jnt). You may want to create your own template notebook. For more information, see Using Templates *(on page 155)*.

Axis Scales

Create multiple axes for 2D graphs. By default, SigmaPlot automatically calculates axis ranges and enables each plot to contain separate X and Y axes.

Tick Marks. Use both major and minor axis tick marks and grid lines. Tick intervals, length, direction, thickness, and color are all adjustable; grid line types are also adjustable. Tick labels can be numeric, time series, or customized, using labels in a worksheet column.

Axis Breaks. You can specify an axis break with a different post-break tick interval.

For more information, see Modifying Axes, Tick Marks, and Grids *(on page 321)*.

Smoothing Data

Smooth sharp variations in dependent values within 2D and 3D data sets using SigmaPlot smoothing algorithms. For more information, see Smoothing 2D and 3D Data *(on page)*.

SigmaPlot Worksheet

The SigmaPlot worksheet is capable of containing data up to 32,000,000 rows by 32,000 columns. Enter data in columns or rows, and perform calculations either row-wise or column-wise.

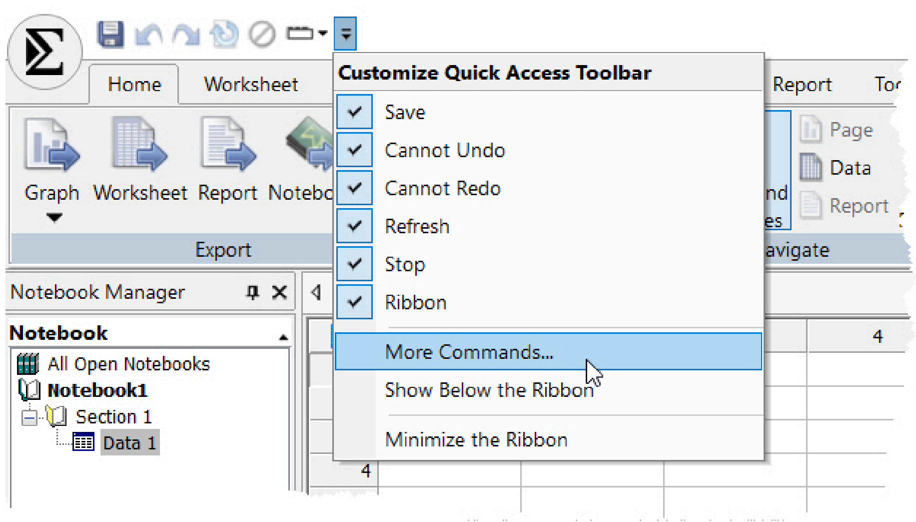
Worksheet cells within columns are adjustable, and capable of holding up to 16 significant digits. Place labels, customized fill colors and patterns, and error bar direction codes into these cells in order to specify changes to graphs. For more information, see Worksheet Basics *(on page 200)*.

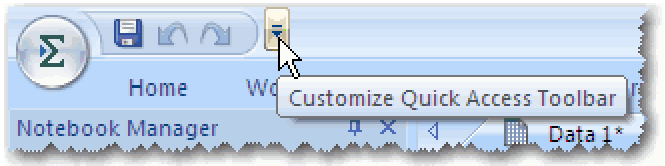
Quick Access Toolbar

When you want to quickly print a file, save, or undo, click the **Quick Access Toolbar**, which contains some of the most commonly used commands. You can also customize it to include just about any SigmaPlot feature you like, including commands for creating graphs, running regressions, or statistical tests.

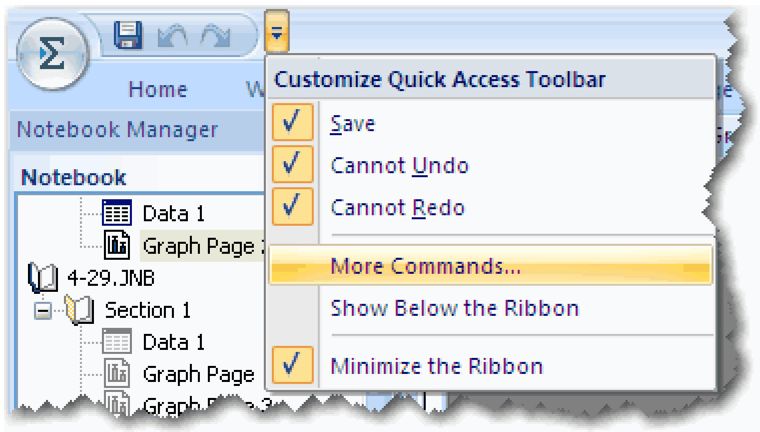
To customize the **Quick Access Toolbar**:

1. Select the **Quick Access Toolbar** drop-down button.

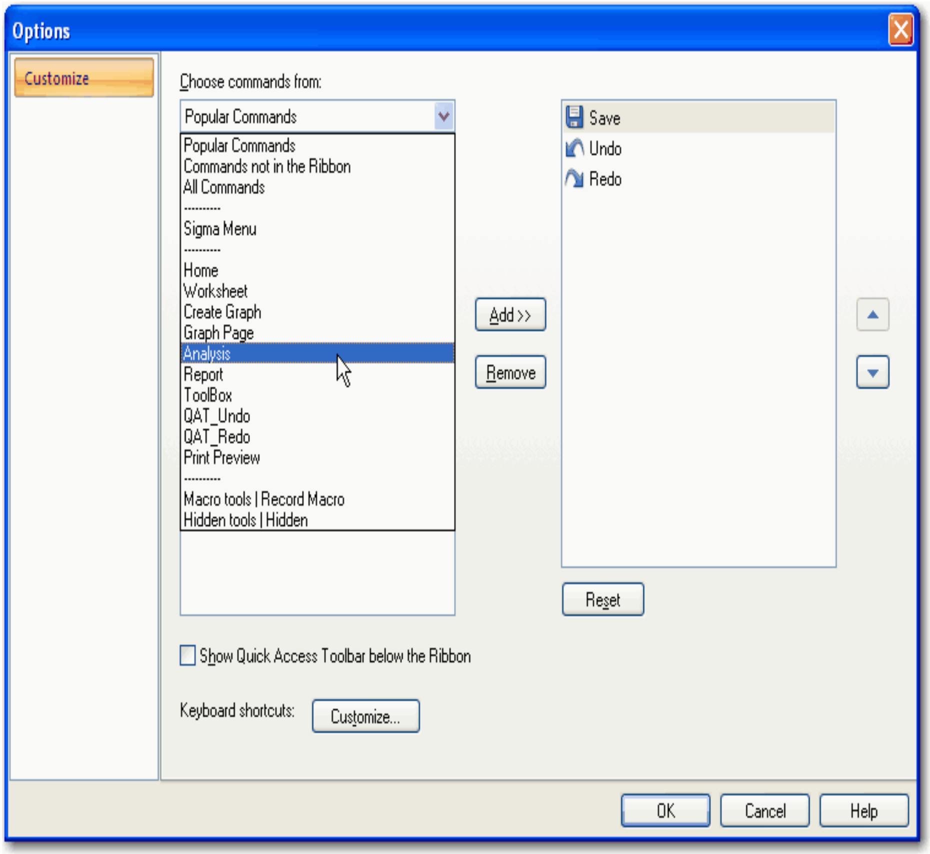




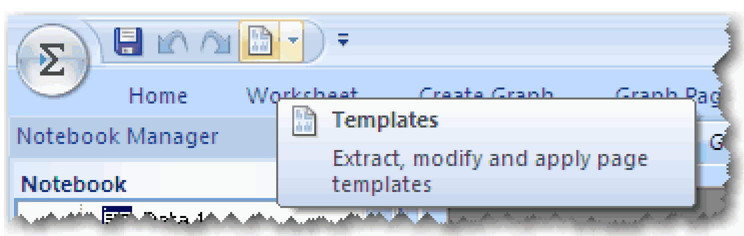
2. Select **More Commands**.



3. Select from the **Commands** list.



4. Double-click or click the **Add** or **Remove** buttons to move commands to the **Quick Access Toolbar**.
5. Click **OK**, and the new command appears in the **Quick Access Toolbar**.



Statistics

SigmaPlot provides SigmaStat's fifty frequently used statistical tests to analyze data, including the Advisor Wizard, to guide you through the process of selecting the appropriate test. Detailed reports are provided in an easy-to-read format and includes interpretations of many results. Result graphs are also provided.

Descriptive statistics are available for all your worksheet columns. The Statistics Worksheet lists basic statistics for all worksheet columns.

Display linear regression lines with confidence and prediction intervals, chart error bars for graphs of column means, and run paired and unpaired *t*-tests between worksheet columns. Use the Histogram feature to compute and plot distributions for data sets. For more information, see Transforms, Regressions, and Graph Analysis *(on page)*.

Regression Wizard

The Regression Wizard steps through curve fitting, plotting, and generating a report.

Transforms

Modify and compute data using SigmaPlot's comprehensive transform language.

Drawing Tools in the Mini Toolbar

When you select objects on the graph page, you can modify them using an immediately visible yet transparent Mini toolbar. You can align objects and text, change font, size, and style, and change color, line type, thickness, and fill pattern of graphs and drawn objects. You can also move object depth from front to back.

Reports

The SigmaPlot Report Editor displays regression results and features complete text editing functionality. For more information, see Using the Report Editor *(on page 362)*.

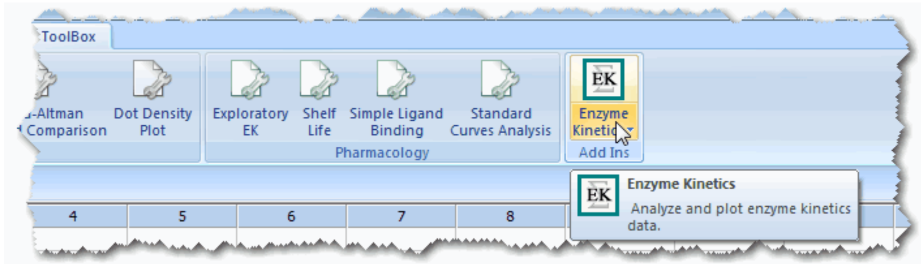
Enzyme Kinetics

Use SigmaPlot's Enzyme Kinetics Module to analyze and graph enzyme kinetics data quickly and easily.

To activate the Enzyme Kinetics module:

1. Click the **Toolbox** tab.
2. In the **Add Ins** group, click **Enzyme Kinetics**.

Figure 4. The Enzyme Kinetics module is located on the Toolbox tab.



Tip:

Click **Help** to find Enzyme Kinetics documentation.

Anatomy of SigmaPlot Graphs

A SigmaPlot graph consists of one or more plots of data, and one or more sets of axes. It uses a specific coordinate system (for example, 2D Cartesian, 3D Cartesian, pie, or polar) and has a specific size and location on the page.

Plots are graphical representations of worksheet data. For example, view data as a vertical bar chart or change the plot to a horizontal bar chart, even after creating the graph. You can even display more than one plot on most graphs.

Axes are the scales that determine position of the graph's data points. Each axis contains tick marks that indicate the type of scale used. Scales range from linear to nonlinear within a Cartesian coordinate system. Customize tick mark labels with worksheet cells or use numeric or time series labels.

The X, Y, and for 3D graphs, Z coordinates, are indicated on each axis by tick marks. An axis can use a linear numeric scale, nonlinear scales such as log, natural log, and probability, or a date/time scale. 2D graphs can have multiple sets of X and Y axes. The axes' tick marks and tick labels, can be numeric, time series, or customized with worksheet column labels.

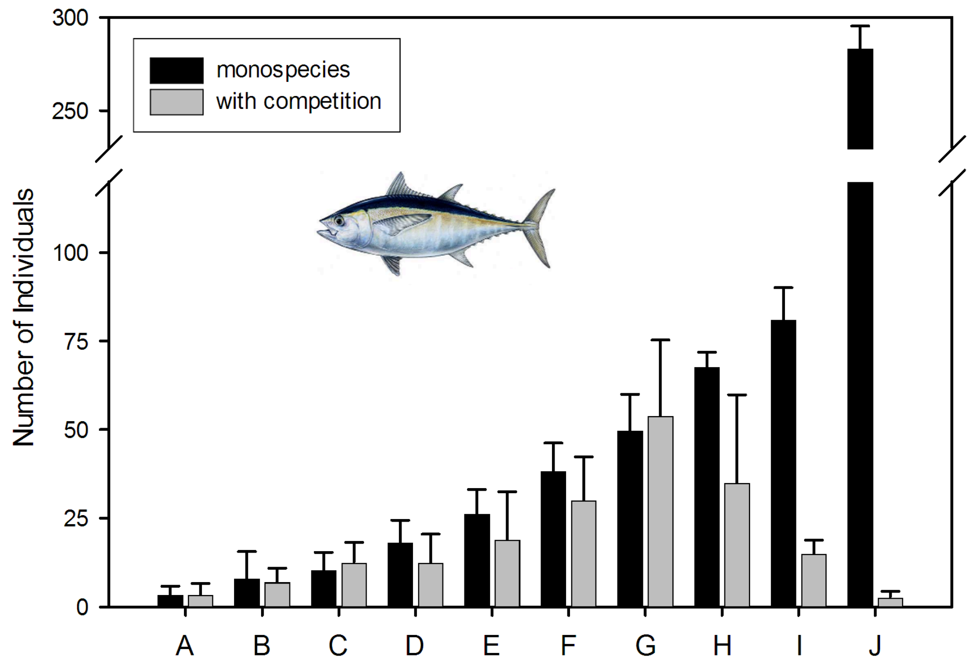
2D Cartesian Graph

The following figures show a examples of 2D Cartesian graphs available in SigmaPlot.

This example of a grouped error bar chart includes:

- A post break tick interval set to a new value.
- A Y axis break at 75% along the axis length.
- Error bars using worksheet column data.
- Bar fill colors using a pattern from a worksheet column.
- X axis tick labels using text from a worksheet column.
- A grouped bar chart with specified bar and group widths.
- Legend symbols and text labels.
- Image art cut from a paint program and pasted onto the page using the Windows Clipboard.

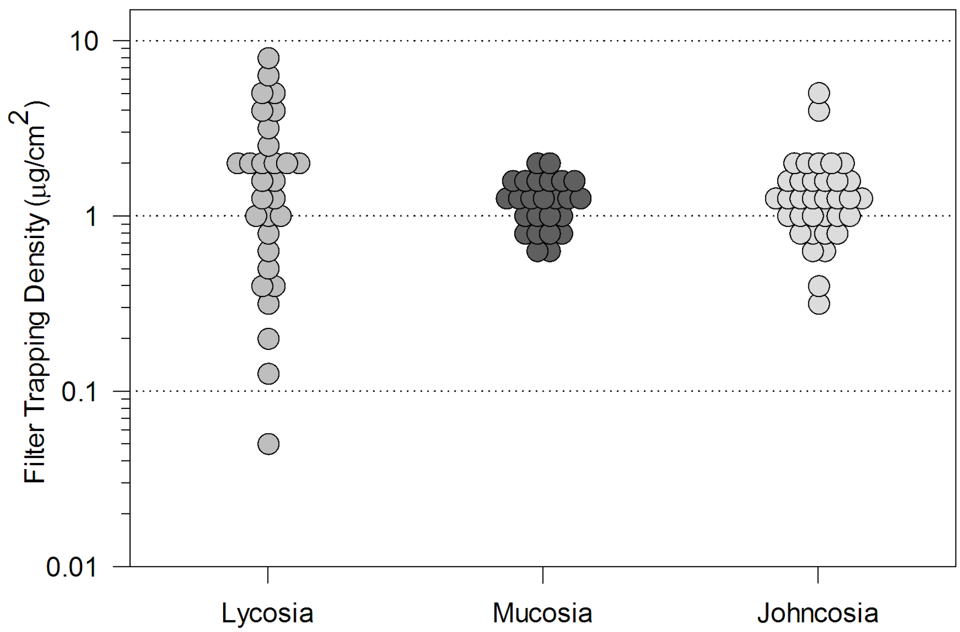
Figure 5. An example of a 2D Cartesian graph.



This example of a multiple scatter plot includes:

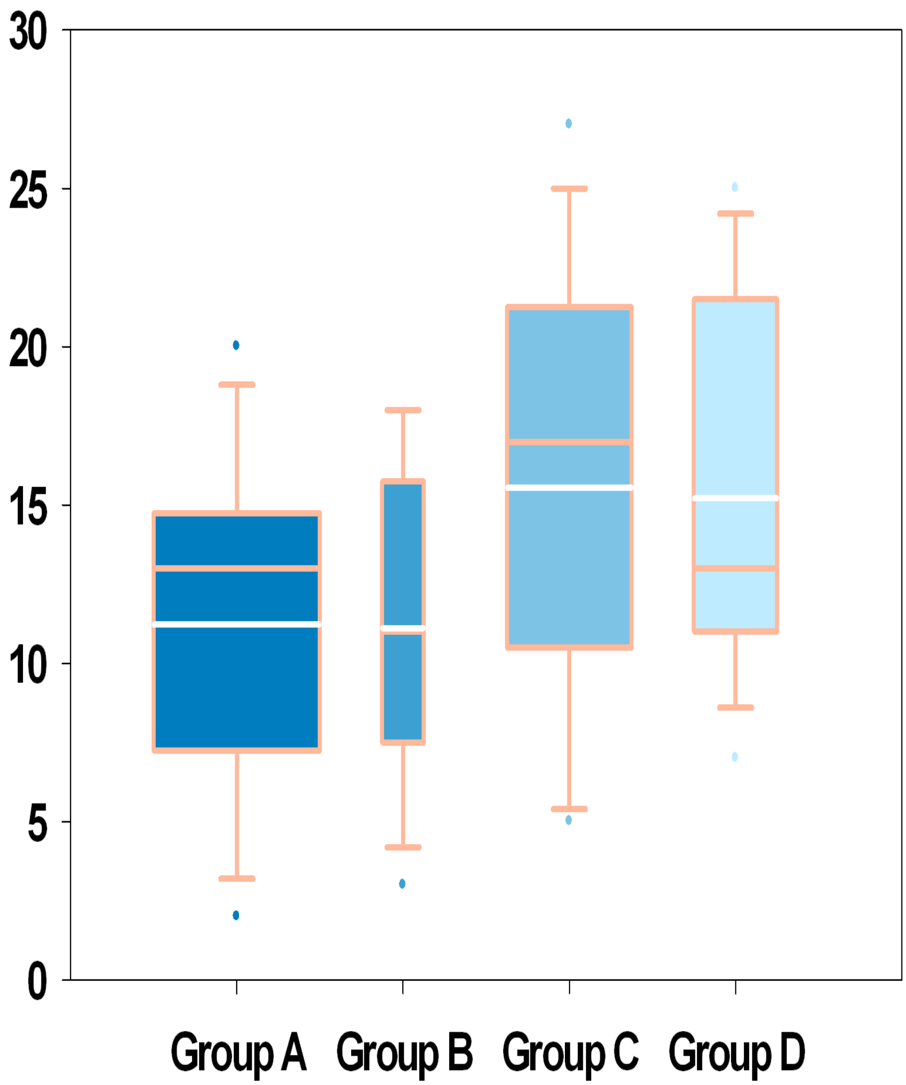
- Common log scale Y axis with major and minor tick marks.
- Custom sized symbols using an incrementing earthtone color scheme.

Figure 6. An example of a multiple scatter plot.



This example of a box plot includes:

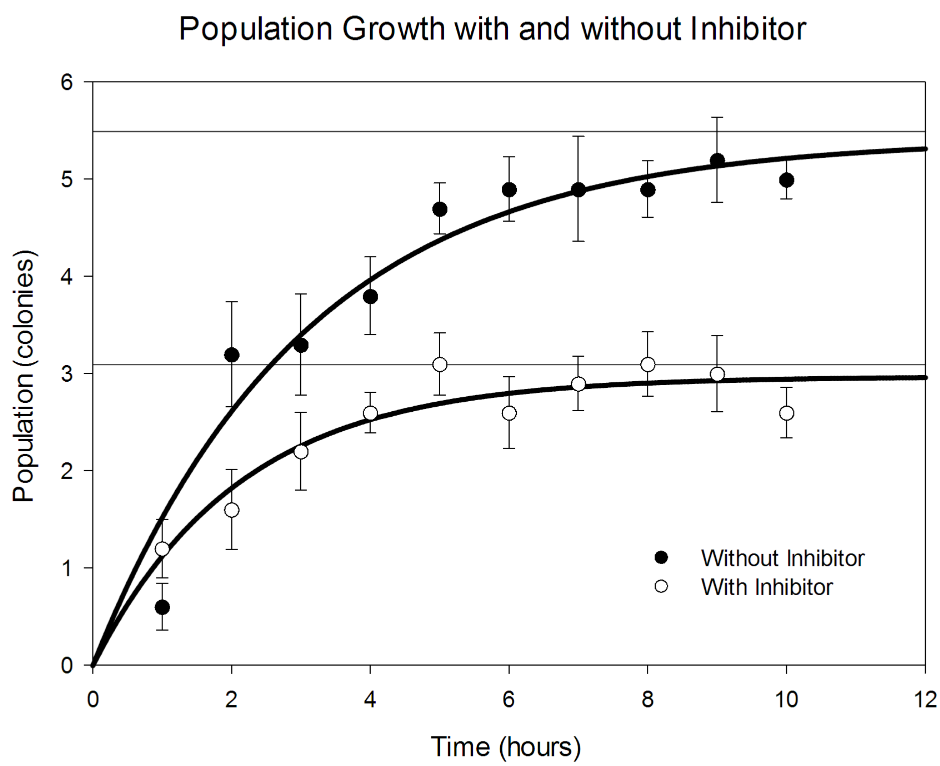
- Variable box widths expressing another variable dimension.
- Tick mark direction pointing outward.
- X axis tick labels using a category axis scale.
- A Tukey box plot with mean value lines.
- Custom fill colors.



This line and scatter plot with error bars includes:

- A scatter plot of column averaged data points, with Y error bars computed from the standard deviations of the data.
- A top X axis with tick marks turned off.
- Y axis with a linear axis scale.
- A left Y axis title.
- A left Y axis with major tick marks.
- Numeric major tick labels.
- An X axis with a linear axis scale.

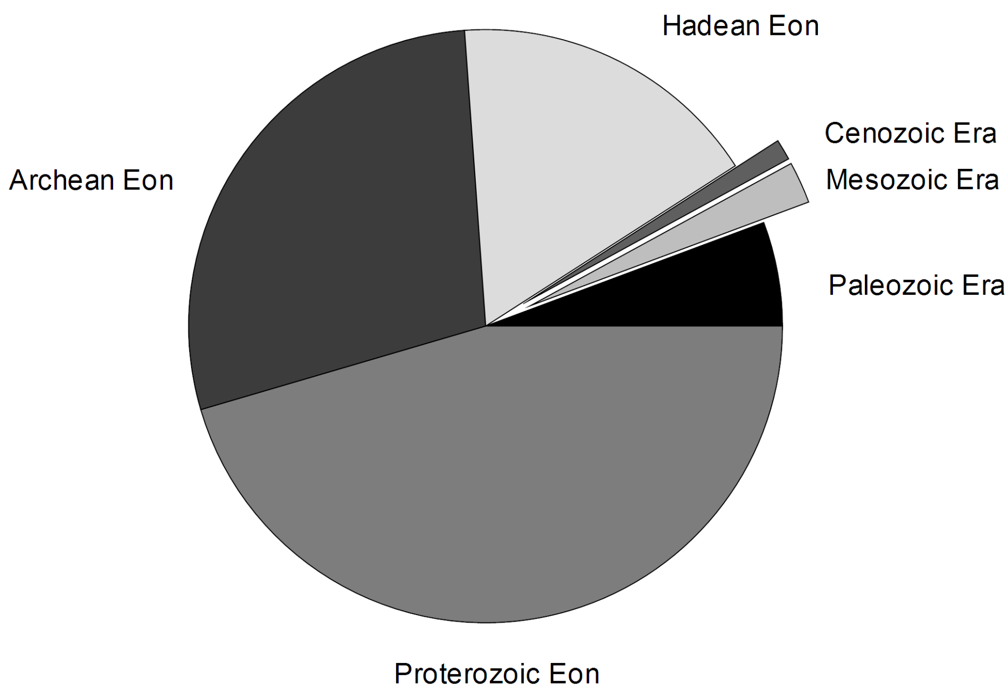
- A bottom X axis title.
- A right Y axis with tick marks turned off.
- An automatically generated legend.
- A reference line.



Pie Chart Example

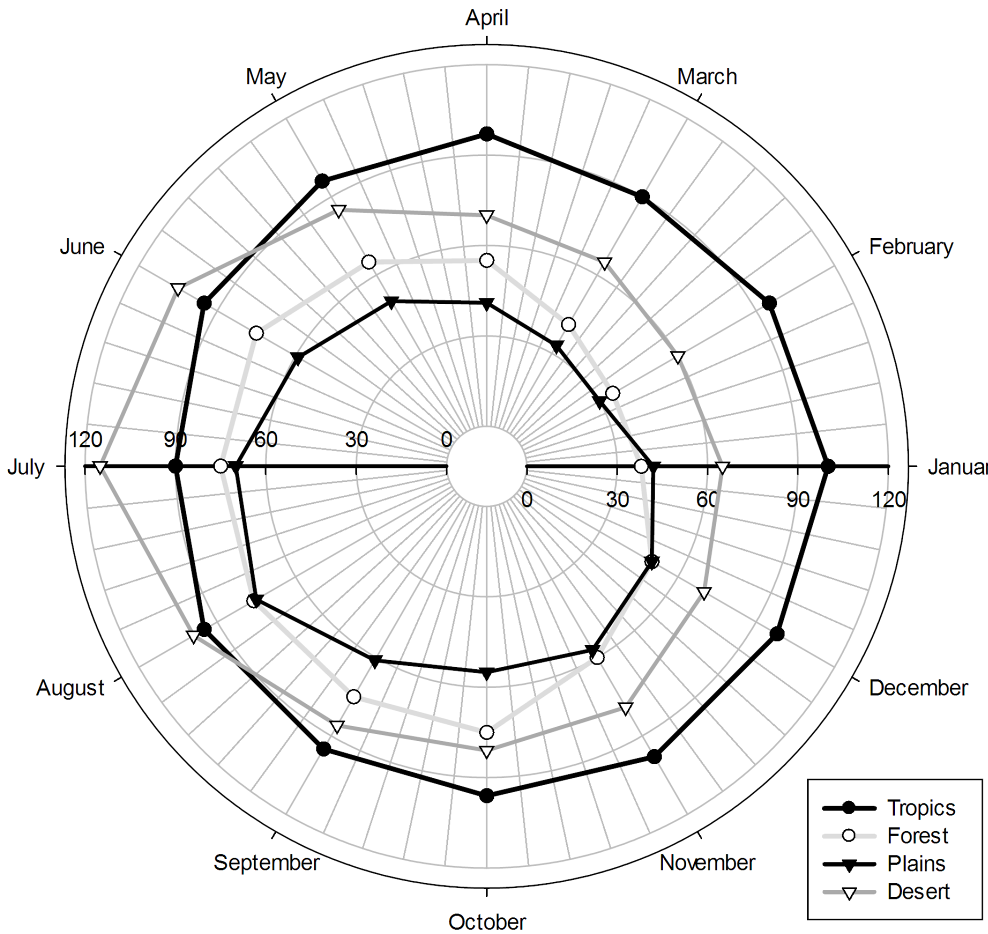
Use Pie charts to display a quick comparison of ratios in a data set. The example figure displays:

- Slice fills
- Text labels
- Exploded slices



Polar Plot Example

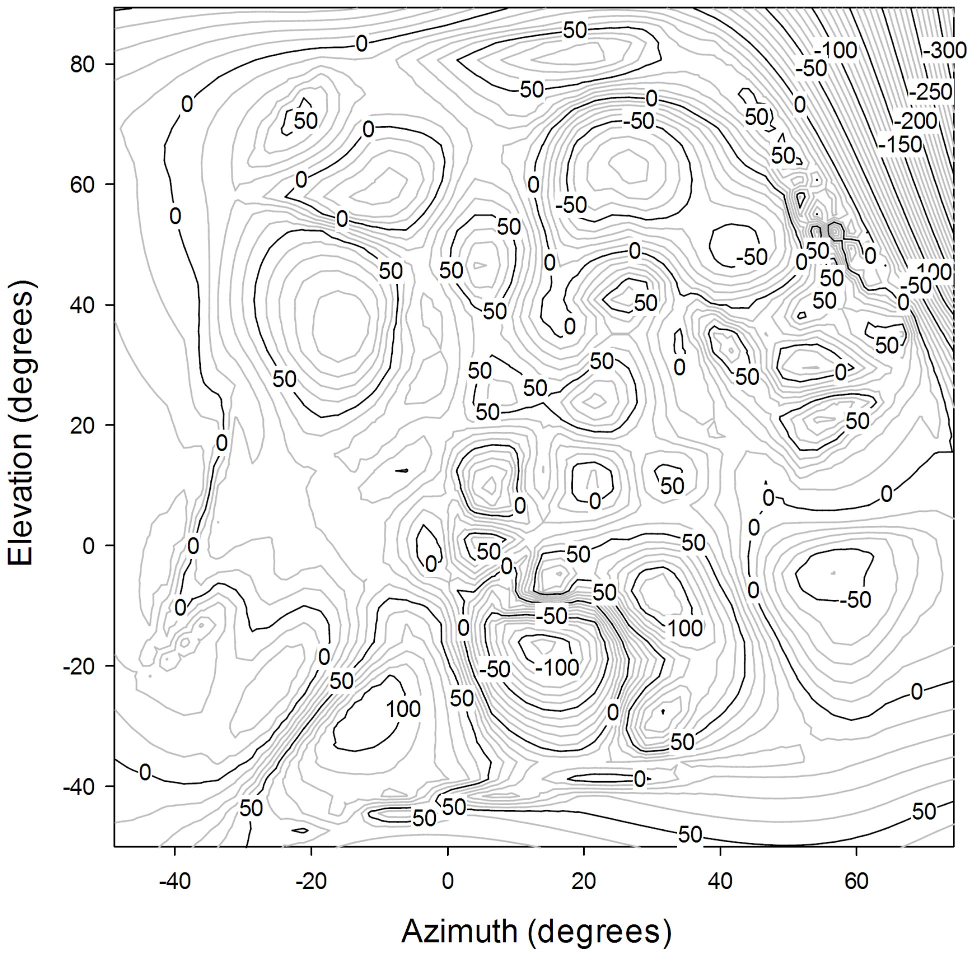
Use polar plots to display modular data such as average monthly temperatures, or satellite positioning in the sky over a period of time.



Contour Plot Example

Use 2D Contour Plots to graph three dimensional data in two dimensions. The following example includes:

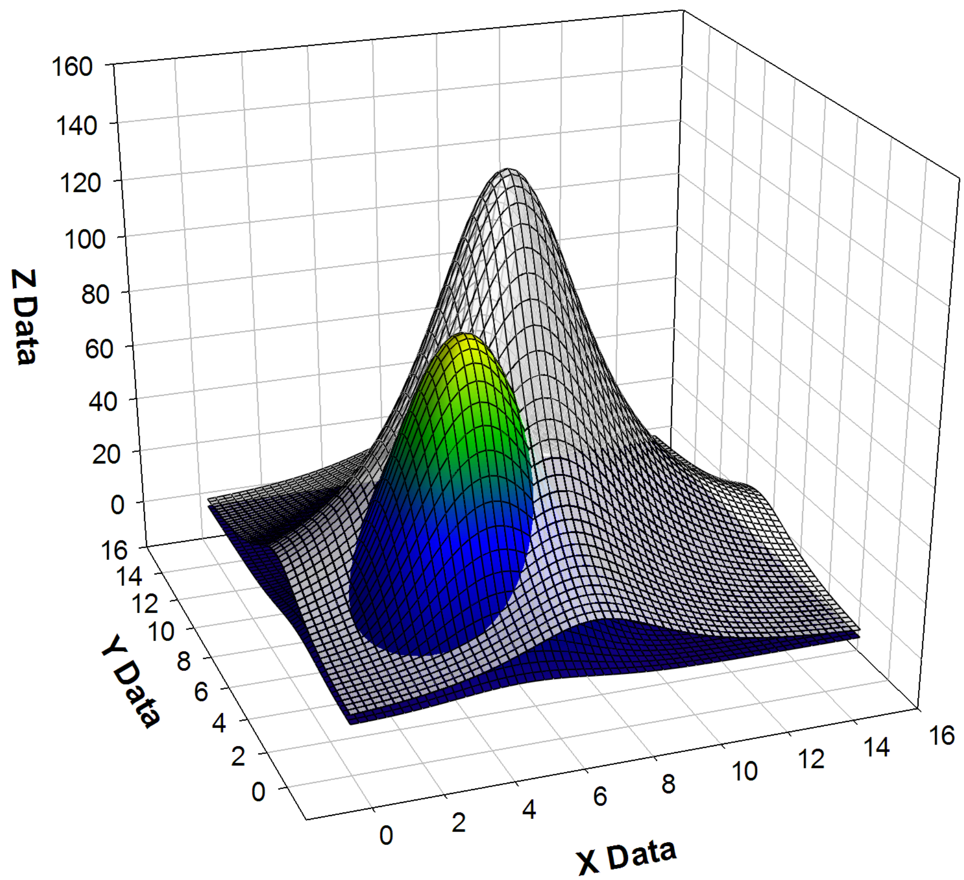
- Major and minor contour lines
- Contour labels



3D Cartesian Graph Example

3D Cartesian Graphs include scatter, 3D trajectory and waterfall plots, mesh plots, and bar charts.

The following figures contain examples of these plots, as well as some additional 3D features.



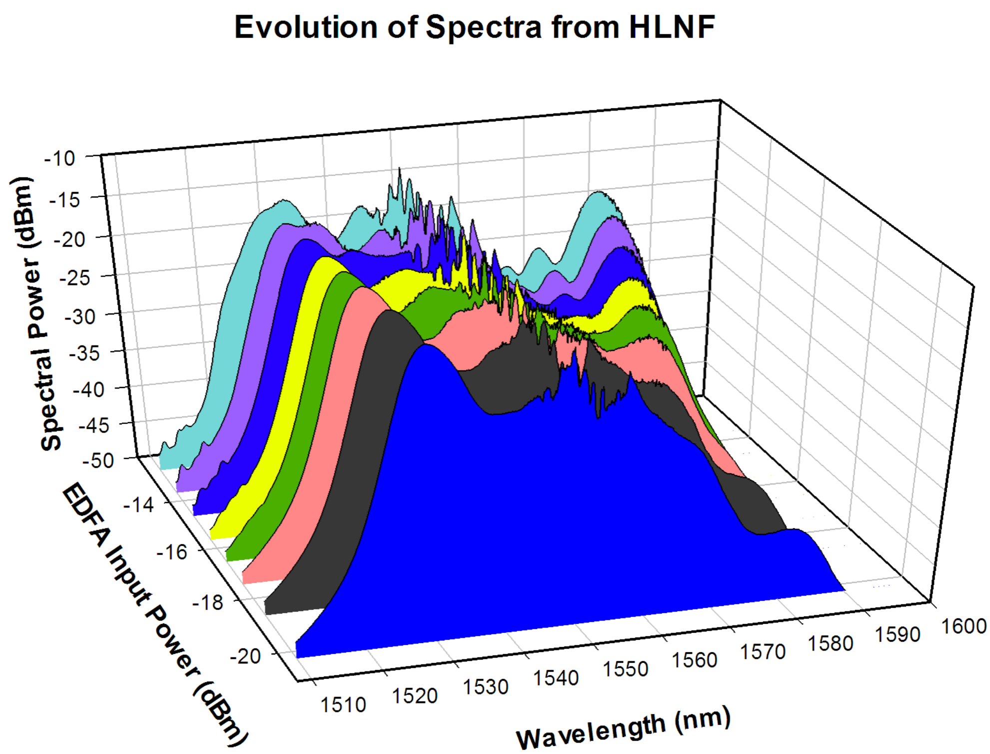
3D graph view can be displayed at any horizontal and vertical rotation. This example of a 3D mesh plot includes:

- A Mesh plot with colored fills and lines.
- A Z axis drawn at left side.
- Grid lines at major tick intervals.
- A Y axis drawn at front bottom.
- Axes automatically move to the front view at any rotation.
- X axis drawn at front bottom.
- Light source shading.
- Overlapping and transparent meshes.

Waterfall Plot Example

3D waterfall plots are stacked line plots along the Y axis of a 3D line plot. Because hidden lines are eliminated, waterfall plots are useful for showing trends of line plots. The following example includes:

- Incremented line fill color
- Eliminated "hidden" lines



SigmaPlot Help

SigmaPlot's online help uses HTML online Help. View the HTML Help using Microsoft Internet Explorer version 4.0 or higher.

Customer Service

If you have any questions concerning your shipment or account, contact your local office *(on page 22)*. Please have your serial number ready for identification when calling.

Getting Technical Support

The services of Systat Technical Support are available to registered customers. Customers may call Technical Support for assistance in using Systat products or for installation help for one of the supported hardware environments.

To reach SigmaPlot Technical Support, select the **Help** tab and then in the **On the Web** group click **Tech Support**.

For more information, see Contacting Systat Software, Inc. *(on page 22)*.

Contacting Systat Software, Inc.

If you would like to be on our mailing list, contact one of our offices or distributors below. We will send you a copy of our newsletter and let you know about Systat Software, Inc. activities in your area.

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What's New in SigmaPlot

Why Use Heat Maps?

Using SigmaPlot's Heat Maps macro, you can make complex data easily understood. One of the original frequent applications of heat maps was to examine population density in a city or region. Some uses of heat maps include:

- **Business analytics.** Exploring data for a range of improvements and degrees of performance.
- **Websites.** Visualizing the behavior of visitors.
- **Exploratory Data Analysis.** Obtaining a quick examination of data before deciding on how to model the data for more in-depth analysis.
- **Molecular Biology.** Studying patterns of difference and similarity in DNA and RNA.
- **Marketing and Sales.** Showing how marketing and sales can be targeted by assessing sale trends and customer response in various geographic or demographic areas.

Related information

Heat Maps *(on page 412)*

Chapter 2. Creating and Modifying Graphs

This chapter provides an overview of the graph creation process using the Graph Wizard, including descriptions of the different graph types and styles available, and common modifications.

A graph is a representation of selected worksheet columns on a graph page. You select the representation, or graph type (for example, 3D scatter plot, vertical bar chart, and so on), when you create a plot or graph. You can change it at any time.

Most plot types can graph many worksheet columns, column pairs, or column triplets. Depending on the plot type, a separate curve or set of bars represents each column. A graph must have at least one plot, but most graphs can hold many more plots, each with a different type and style.

Setting Graph Defaults

Changing graph defaults only affects the new graphs that you create.

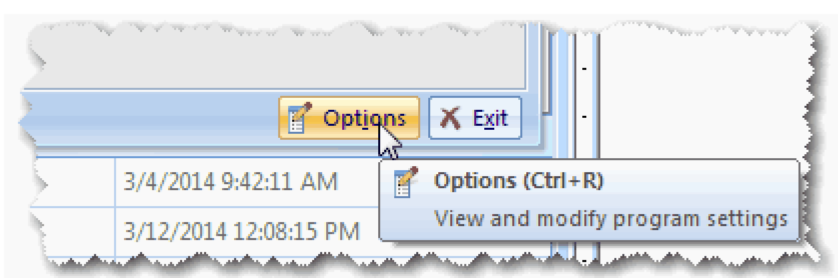
1. To change existing graphs:

    a. Select the graph.

    b. Change its properties using the **Graph Wizard**, **Graph Properties**, or other dialog boxes and ribbon items.
    The graph default options are intentionally limited and simple. If you want to use more complex graph defaults, use templates or the **Graph Style Gallery** to create complex graphs that can be applied to data as a template, bypassing graph creation entirely.

2. To change graph defaults:

    a. Click the **Main Button**  and then click the **Options** button.

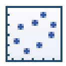
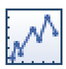
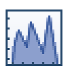
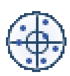
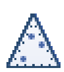


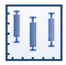
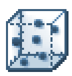
b. On the **Options** dialog box, click the **Graph** tab.

c. Change the graph defaults options as desired.

SigmaPlot Graph Types

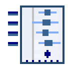
There are more than a dozen graph types available in SigmaPlot. Choose a graph type on the **Create Graph** tab.

Scatter Plot		Plots data as XY points using symbols. See SigmaPlot Graph Styles *(on page 55)*.
Line Plot		Plots data as XY points connected with lines. See SigmaPlot Graph Styles *(on page 55)*.
Line and Scatter Plot		Plots data as XY points using symbols connected with lines. See SigmaPlot Graph Styles *(on page 55)*.
Area Plot		See Plots data as XY points with regions below or between curves filled with a color or pattern. *(on page 66)*.
Polar Plot		Plots data using angles and distance from center. See Arranging Data for Polar Plots *(on page 98)*.
Radar Plot		Plots multiple variables using distance from the origin. See Arranging Data for 2D Plots *(on page 94)*.
Ternary Plot		Plots data on a coordinate system based on three different components which always add up to 100%. See Arranging Data for a Ternary Graph *(on page 99)*.
Vertical Bar Chart		Plots data as Y points with vertical bars. See Arranging Data for 2D Plots *(on page 94)*.

Horizontal Bar Chart		Plots data as X points with horizontal bars. See Bar Charts *(on page 246)*.
Box Plot		Plots data as the median and percentiles. See Box Plots *(on page 73)*.
Pie Chart		Plots data as the median and percentiles. See Box Plots *(on page 73)*.
Bubble Plot		Plots data as the median and percentiles. See Box Plots *(on page 73)*.
Contour Plot		Plots data as XYZ values in 2D space. Format data columns as: many Z; single XY, many Z; or XYZ triplet. See Data for Contour and Mesh Plots *(on page 102)*.
3D Scatter Plot		Plots data as XYZ data points in 3D space. Format data columns as: many Z; single XY, many Z; or XYZ triplet. See Data for Contour and Mesh Plots *(on page 102)*.
3D Line Plot		Plots data as XYZ data points connected with lines. Format data columns as: many Z; single XY, many Z; or XYZ triplet. See Data for Contour and Mesh Plots *(on page 102)*.
3D Mesh Plot		Plots data as a 3D surface. Format data columns as: many Z; single XY, many Z; or XYZ triplet. See Data for Contour and Mesh Plots *(on page 102)*.
3D Bar Chart		Plots data as Z values on an XY grid. Format data columns as: many Z; or single XY, many Z. See Data for Contour and Mesh Plots *(on page 102)*.
Vector Plot		Plots an XY column pair for the vector start point and an XY column pair for the vector end point. Format data columns as:

XYXY; or XYAM. See Arranging Data for a Vector Plot *(on page 97)*.

Forest Plot



Plots data as a column for the name of the study, then the values, confidence levels, weights, and overall result data. See Arranging Forest Plot Data *(on page 284)*.

Statistical Graphs

This graph type is only available on the **Create Graph - Type** panel of the Graph Wizard.

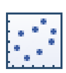
Plots data as a column for the name of the study, then the values, confidence levels, weights, and overall result data. See Statistical Graphs *(on page 319)*.

SigmaPlot Graph Styles

Many graph types have several styles to choose from. When you select a graph type from the **Create Graph** tab, you are prompted to choose a graph style.

Scatter Plots

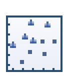
Simple Scatter



Plots a single set of XY pairs. Format data columns as:

- XY Pair
- Single X
- Single Y

Multiple Scatter

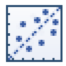


Plots multiple sets of XY pairs. Format data columns as:

- XY Pairs
- Single Y, Many X
- Single X, Many Y
- Many X

- Many Y
- XY Category
- X Category
- Y Category

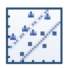
Simple Regression



Plots a single set of XY pairs with a regression line. Format data columns as:

- XY Pair
- Single X
- Single Y

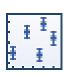
Multiple Regressions



Plots multiple sets of XY pairs with regression lines. Format data columns as:

- XY Pairs
- Single Y, Many X
- Single X, Many Y
- Many X
- Many Y
- XY Category
- X Category
- Y Category

Simple Error Bars



Plots a single set of XY pairs with error bars. If using worksheet columns or asymmetric error bar columns, format data columns as:

- XY Pair; or Single Y

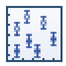
If using columns means, the first column entry, or the last column entry as symbol values, format data columns as:

- Single X, Many Y
- Many Y

If using Row Means, Row Median, First Row Entry, or Last Row Entry as symbol values, format data columns as:

- Single X, Single Y Replicate
- Y Replicate

Multiple Error Bars



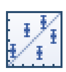
Plots multiple sets of XY pairs with error bars. If using worksheet columns, asymmetric error bar columns, columns means, the first column entry, or the last column entry as symbol values, format data columns as:

- X Many Y
- Many Y

If using row means, row median, first row entry, or last row entry as symbol values, format data columns as:

- Single X, Many Y Replicates
- Many Y Replicates

Simple Error Bars & Regression



Plots a single set of XY pairs with error bars and a regression line. If using worksheet columns or asymmetric error bar columns, format data columns as:

- XY Pair
- Single Y

If using columns means, the first column entry, or the last column entry as symbol values, format data columns as:

- Single X Many Y
- Many Y

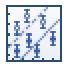
If using Row Means, Row Median, First Row Entry, or Last Row Entry as symbol values, format data columns as:

- Single X, Single Y replicate
- Y replicate

If using By Category, Mean, or By Category, Median, format data columns as:

- Category, Many Y

Multiple Error Bars & Regressions



Plots multiple sets of XY pairs with error bars and regression lines. If using worksheet columns, asymmetric error bar columns, columns means, the first column entry, or the last column entry as symbol values, format data columns as:

- Single X Many Y
- Many Y

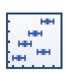
If using Row Means, Row Median, first Row Entry, or last Row Entry as symbol values, format data columns as:

- Single X, Many Y Replicates
- Many Y Replicates

If using By Category, Mean, or By Category, Median, format data columns as:

- Category, Many Y

Simple Horizontal Error Bars



Plots XY pairs with horizontal error bars. If using worksheet columns or asymmetric error bar columns as the as symbol values, format as:

- XY pairs
- Single X, Single Y, Many X
- Many X

If using column means, column median, the first column entry, or the last column entry as symbol values, format data as:

- Single Y, Many X
- Many X

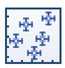
If using Row Means, Row Median, the First Row Entry, or the Last Row Entry as symbol values, format data columns as:

- Single X Replicates
- Single Y, single X Replicates
- Many X Replicates
- Single Y, Many X Replicates

If using By Category, Mean, or By Category, Median, format data columns as:

- Category, Many Y

Bi-directional Error Bars



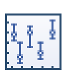
Plots XY pairs with both horizontal and vertical error bars. Format data columns as XY pairs. If using worksheet columns or asymmetric error bar columns as the as symbol values, format as:

- XY pairs
- Single X
- Single Y, Many X
- Many X

If using column means, column median, the first column entry, or the last column entry as symbol values, format data as:

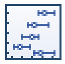
- Single Y, Many X
- Many X

Vertical Asymmetric Error Bars



Plots one X column and at least one Y column. Format data columns as:

- X Many Y
- Many Y
- XY Pairs

Horizontal Asymmetric Error Bars 

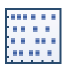
Plots one Y column and at least one X column. Format data columns as:

- Y Many X
- Many X
- YX Pairs

Vertical Point Plot 

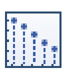
Plots columns of data as Y values. Format data columns as:

- Many Y
- Single X, Many Y
- Many Y Replicates
- Single X, Many Y Replicates

Horizontal Point Plot 

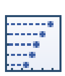
Plots columns of data as X values. Format data columns as: Many X

- Single Y, Many X
- Many X Replicates
- Single Y, Many X Replicates

Vertical Dot Plot 

Plots a column of data as Y values. Format data columns as:

- Many Y
- Single X Many Y
- XY pairs
- X Category

Horizontal Dot Plot 

Plots a column of data as X values. Format data columns as:

- Many X
- Single Y, Many X
- YX pairs

Line Plots

Simple Straight Line

Plots a single set of XY pairs connecting the data points with straight lines. Format data columns as:

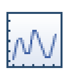
- XY Pairs
- Single X
- Single Y

Multiple Straight Lines

Plots multiple sets of XY pairs connecting the data points with straight lines. Format data columns as:

- XY Pairs
- Many X
- Many Y
- Single X, Many Y
- Many X
- Single Y

Simple Spline Curve



Plots a single set of XY pairs connecting the data points with a spline curve. Format data columns as:

- XY Pairs
- Single X
- Single Y

Multiple Spline Curves

Plots multiple sets of XY pairs connecting the data points with spline curves. Format data columns as:

- XY Pairs
- Many X
- Many Y
- Single X, Many Y
- Single Y, Many X

Simple Vertical Step Plot

Plots a single set of XY pairs connecting the data points with vertical and horizontal lines, starting with vertical. Format data columns as:

- XY Pairs
- Single X
- Single Y

Multiple Vertical Step Plot

Plots multiple sets of XY pairs connecting the data points with vertical and horizontal lines, starting with vertical. Format data columns as:

- XY Pairs
- Many X
- Many Y
- Single X, Many Y
- Single Y, Many X

Simple Horizontal Step Plot

Plots a single set of XY pairs connecting the data points with vertical and horizontal lines, starting with horizontal. Format data columns as:

- XY Pairs
- Single X
- Single Y

Multiple Horizontal Step Plot

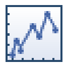
Plots multiple sets of XY pairs connecting the data points with vertical and horizontal lines, starting with horizontal. Format data columns as:

- XY Pairs
- Many X
- Many Y

- Single X, Many Y
- Single Y, Many X

Line and Scatter Plots

Simple Straight Line



Plots a single set of XY pairs connecting symbols with straight lines. Format data columns as:

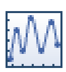
- XY Pairs
- Single X
- Single Y

Multiple Straight Lines

Plots multiple sets of XY pairs connecting symbols with straight lines. Format data columns as:

- XY Pairs
- Many X
- Many Y
- Single X, Many Y
- Single Y, Many X

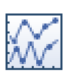
Simple Spline Curve



Plots a single set of XY pairs connecting symbols with a spline curve. Format data columns as:

- XY Pairs
- Single X
- Single Y

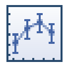
Multiple Spline Curves



Plots multiple sets of XY pairs connecting symbols with spline curves. Format data columns as:

- XY Pairs
- Many X
- Many Y

- Single X, Many Y
- Single Y, Many X

Simple Error Bars 

Plots a single set of XY pairs as symbols with error bars connected with straight lines. If using worksheet columns or asymmetric error bar columns, format data columns as:

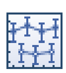
- XY Pair
- Single Y

If using columns means, the first column entry, or the last column entry as symbol values, format data columns as:

- X Many Y
- Many Y

If using row means, row median, first row entry, or last row entry as symbol values, format data columns as:

- X, Y Replicate
- Y Replicate

Multiple Error Bars 

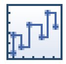
Plots multiple sets of XY pairs as symbols with error bars connected with straight lines. If using worksheet columns, asymmetric error bar columns, columns means, the first column entry, or the last column entry as symbol values, format data columns as:

- X Many Y
- Many Y

If using row means, row median, first row entry, or last row entry as symbol values, format data columns as:

- X, Many Y Replicates
- Many Y Replicates

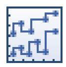
Simple Vertical Step Plot



Plots a single set of XY pairs connecting symbols with vertical and horizontal lines, starting with vertical. Format data columns as:

- XY Pairs
- Single X
- Single Y

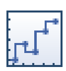
Multiple Vertical Step Plot



Plots a multiple sets of XY pairs connecting symbols with vertical and horizontal lines, starting with vertical. Format data columns as:

- XY Pairs
- Many X
- Many Y
- Single Y, Many X
- Single X, Many Y

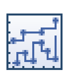
Simple Horizontal Step Plot



Plots a single set of XY pairs connecting symbols with vertical and horizontal lines, starting with horizontal. Format data columns as:

- XY Pairs
- Single X
- Single Y

Multiple Horizontal Step Plot



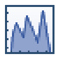
Plots a multiple sets of XY pairs connecting symbols with vertical and horizontal lines, starting with horizontal. Format data columns as:

- XY Pairs
- Many X
- Many Y

- Single Y, Many X
- Single X, Many Y

Area Plots

Simple Area

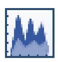


Plots single set of XY pairs as a line plot with a downward fills.

Format data columns as:

- XY Pairs
- Single X
- Single Y

Multiple Area



Plots multiple sets of XY pairs as line plots with downward fills.

Format data columns as:

- XY Pairs
- Many Y
- Single X, Many Y
- Many X
- Single Y, Many X

Vertical Area

Plots single set of YX pairs as a line plot with a left direction fill.

Format data columns as:

- Single X
- YX Pair

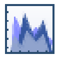
Multiple Vertical Area

Plots multiple sets of YX pairs as line plots with left direction fills.

Format data columns as:

- Many X
- Single Y, Many X

Complex Area Plot

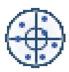


Plots multiple line plots with downward fills and intersections. Format data columns as:

- XY Pairs
- X Many Y
- Y Many X
- Many X
- Many Y

Polar Plots

Scatter



Plots angle and distance data as symbols. Format data columns as:

- Theta, R Pairs
- XY Pairs
- Many Theta
- Many R
- Single Theta, Many R
- R, Many Theta

Lines

Plots angle and distance data points connected with lines. Format data columns as:

- Theta, R Pairs
- XY Pairs
- Many Theta
- Many R
- Single Theta, Many R
- R, Many Theta

Scatter & Lines

Plots angle and distance data as symbols connected with lines. Format data columns as:

- Theta, R Pairs
- XY Pairs
- Many Theta
- Many R
- Single Theta, Many R
- R, Many Theta

Radar Plots

Radar Scatter

Plot data as distance from the origin using symbols. Format data columns as:

- Label Many Series
- Many Series

Radar Line

Plot data as distance from the origin connected with straight lines. Format data columns as:

- Label Many Series
- Many Series

Radar Line and Scatter

Plot data as distance from the origin using symbols connected with straight lines. Format data columns as:

- Label Many Series
- Many Series

Radar Vector Arrow Lines

Plot data as arrows emanating from the origin. Format data columns as:

- Label Many Series
- Many Series

Radar Line and Error Band

Plot data as a line with an encompassing area band from line and error value columns. Format data columns as:

- Label Many Series
- Many Series

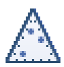
Radar Area

Plot data as distance using connecting lines and area fill from line to origin. Format data columns as:

- Label Many Series
- Many Series

Ternary Plots

Scatter



Plots ternary triplet data as symbols. Format data columns as:

- Ternary Triplets
- Ternary XY Pairs
- Ternary YZ Pairs
- Ternary XZ Pairs

Lines

Plots ternary triplet data as data points connected with lines. Format data columns as:

- Ternary Triplets
- Ternary XY Pairs
- Ternary YZ Pairs
- Ternary XZ Pairs

Scatter & Lines

Plots ternary triplet data as symbols connected with lines. Format data columns as: X,Y, and Z values; or data.

- Ternary Triplets
- Ternary XY Pairs
- Ternary YZ Pairs
- Ternary XZ Pairs

Vertical Bar Charts

Simple Bar

Plots a single column of data as Y values. Format data columns as:

- XY Pair
- Single Y

Grouped Bar

Plots multiple columns of data in a series of bars. Format data columns as:

- Single X, Many Y
- Many Y
- Many Y Replicates
- Single X, Many Y Replicates

Simple Error Bars

Plots data as Y values with error bars. If using worksheet columns or asymmetric error bar columns as the symbol value source, format data columns as:

- Single Y
- XY Pair

If using columns means, the first column entry, or the last column entry as symbol values, format data columns as:

- Single X Many Y
- Many Y

If using row means, row median, the first row entry, or the last row entry, format data columns as:

- Single Y Replicate
- X, Y Replicate

Grouped Error Bars

Plots data as multiple sets of Y values in a series of bars with error bars. If using worksheet columns or asymmetric error bar columns as the symbol value source, format data columns as:

- Many Y
- Single X, Many Y

If using row means, row median, the first row entry, or the last row entry, format data columns as:

- Many Y Replicates
- Single X
- Many Y Replicates

Error bar values are from the worksheet.

Stacked Bars

Plots multiple columns of data as a series of stacks in bars. Format data columns as:

- Single X, Many Y
- Many Y
- Many Y Replicates
- Single X, Many Y Replicates

Horizontal Bar Charts

Simple Bar

Plots a single column of data as X values. Format data columns as:

- XY Pairs
- Single X

Grouped Bar

Plots multiple columns of data in a series of bars. Format data columns as:

- Single Y, Many X
- Many X, Many X Replicates
- Single Y, Many X Replicates

Simple Error Bars

Plots data as X values with error bars. If using worksheet columns or asymmetric error bar columns as the symbol value source, format data columns as:

- Single X
- YX pair

If using columns means, the first column entry, or the last column entry as symbol values, format data columns as:

- Many X;
- Single Y, Many X

If using row means, row median, the first row entry, or the last row entry, format data columns as:

- Many X Replicates
- Single Y, Many X Replicates

Error bar values are from the worksheet.

Grouped Error Bars

Plots data as multiple sets of X values in a series of bars with error bars. If using worksheet columns or asymmetric error bar columns as the symbol value source, format data columns as:

- Single Y
- Many X
- Many X

If using row means, row median, the first row entry, or the last row entry, format data columns as:

- Many X Replicates
- Single Y, Many X Replicates

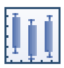
Error bar values are from the worksheet.

Stacked Bars 

Plots multiple columns of data as a series of stacks in bars. Format data columns as:

- Single Y, Many X
- Many X
- Single Y
- Many X Replicates

Box Plots

Vertical 

Plots the median, 10th, 25th, 75th, and 90th percentiles as vertical boxes with error bars. Format data columns as:

- Many Y
- Single X, Many Y

Error bar values are column means.

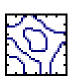
Horizontal 

Plots the median, 10th, 25th, 75th, and 90th percentiles as horizontal boxes with error bars. Format data columns as:

- Many X
- Single Y, Many X

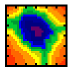
Error bar values are column means.

Contour Plots

Contour 

Plots data XYZ values in 2D space. Format data columns as:

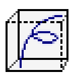
- XYZ Triplet
- Many Z
- XY, Many Z

Filled Contour 

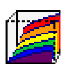
Plots data XYZ values in 2D space filling in the area between contour levels. Format data columns as:

- XYZ Triplet
- Many Z
- XY, Many Z

3D Line Plots

3D Trajectory 

Plots data as XYZ data points connected with lines.

3D Waterfall 

Plots data as XYZ data points, but only displays X or Y gridlines. Format data as:

- Many Z
- Single XY
- Many Z

Creating Graphs

Once you've entered data into a SigmaPlot worksheet, creating graphs is quick and easy.

Click the **Create Graph** tab, and then click any one of the available graph types and styles in the **2D Graphs** and **3D Graphs** groups.
The **Graph Wizard** appears and walks you step-by-step the rest of the way to creating your graph.

Tip:
You can either select the worksheet columns to plot before creating your graph by dragging the pointer over your data, or you can select data columns later in the **Graph Wizard**. You

can also select data ranges. For more information, see Entering Data Ranges into the Graph Wizard *(on page 76)*.

You can also create graphs using existing in-house styles that are available both in the easy-to-find Graph Style Gallery and in SigmaPlot templates. For more information, see Using Templates *(on page 155)*.

Creating a Graph from the Quick Start Screen

When you first start SigmaPlot, the **Quick Start** screen appears with the **Welcome to SigmaPlot** tab in view. From here, you can create a new notebook or open an existing file.

Creating Pre-Formatted Worksheets. You can also create pre-formatted worksheets. These are empty worksheets that contain predefined sections that represent the data formats used for creating SigmaPlot graphs. To do this, click **Create graph**. From here, you have most of the control of creating graphs that you have in the standard SigmaPlot Graph Wizard, but in one dialog box.

Figure 7. The SigmaPlot Quick Start Screen

1. **Select a graph type.** On the top of the dialog box, you see a row of **Graph Style** icons. Click one. Its available graph styles appear on the *Graph Style* menu on the left hand side of the *Start Up* screen.
2. **Create another pre-formatted worksheet.** Click the and then click **Quick Start**.

Creating Graphs Using the Graph Wizard

While it's often times most easy to create a graph using any of the graph styles and types on the Create Graph tab, you can also create a graph directly from the Graph Wizard.

To create a graph using the Graph Wizard:

1. On the **Create Graph** tab, in the **Wizard** group, click **Graph Wizard**.
2. In the **Graph Wizard**, under **Graph Types**, select the type of graph you want to make.
3. Click **Next**.
4. Under **Graph Styles**, select the desired graph style.
5. Click **Next**. If the graph style you have chosen uses error bars, you are prompted to choose an error bar source and a value to use for the error bars. For more information, see Creating 2D Scatter Plots with Error Bars *(on page 251)*.
6. Click **Next**.

7. Under **Data format**, select how your data is formatted, and click **Next**.
8. From the **Data for** drop down list, select the worksheet columns that correspond to the axis or error bar of your plot.
   You can also drag a range of data on the worksheet using the mouse.

   > **Tip:**
   > If you create a graph using **Microsoft Excel**, you'll have to manually enter the ranges. Or you can select a range of data by entering the range manually into the **Data for** box. After entering the range, press **Enter**. The range appears in the **Graph Wizard**. For more information, see Entering Data Ranges into the Graph Wizard *(on page 76)*.

   If you make a mistake while selecting data, double-click the mistaken column in the **Selected Columns** list to clear the selection.
9. Click **Finish** to create the plot.

Entering Data Ranges into the Graph Wizard

The simplest way to select a region of data is to drag the columns or range using the mouse. You can, however, manually enter the ranges into the Graph Wizard. This is necessary when creating graphs using Microsoft Excel where it is not possible to use the mouse to select a range of data.

The Graph Wizard supports the following formats when specifying a region in the worksheet:

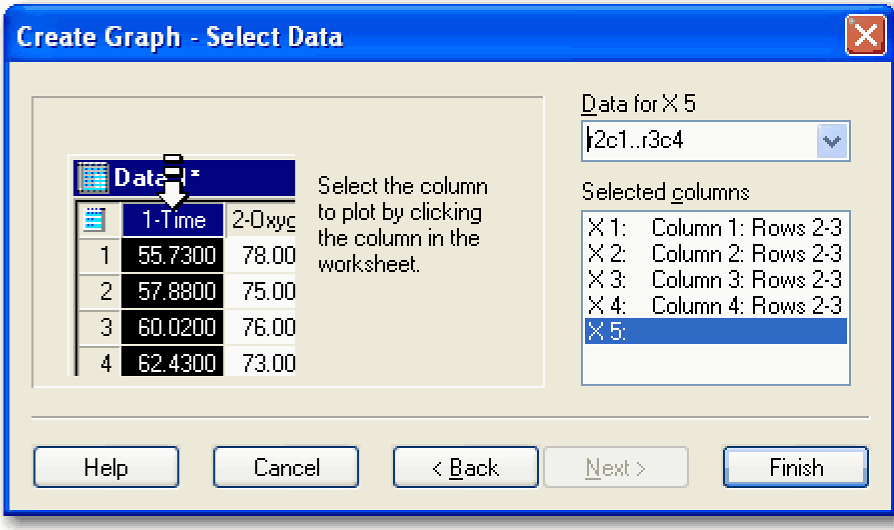
rc Notation

Specify a cell using the letter r to denote the row, and the letter c to denote the column. For example, to specify the cell in the third row and twelfth column, you would enter r3c12.

To specify a rectangular region, follow the upper left cell of the region by the lower right cell, separated by two periods. For example, if the upper left cell of the region is r2c1 (second row, first column), and the lower right cell of the region is r4c4 (fourth row, fourth column), you would enter r2c1..r4c4 into the Graph Wizard.

You can also specify the column first. For example, both c2r2...c4r5 and r2c2...r5c4 denote the same region in the worksheet.

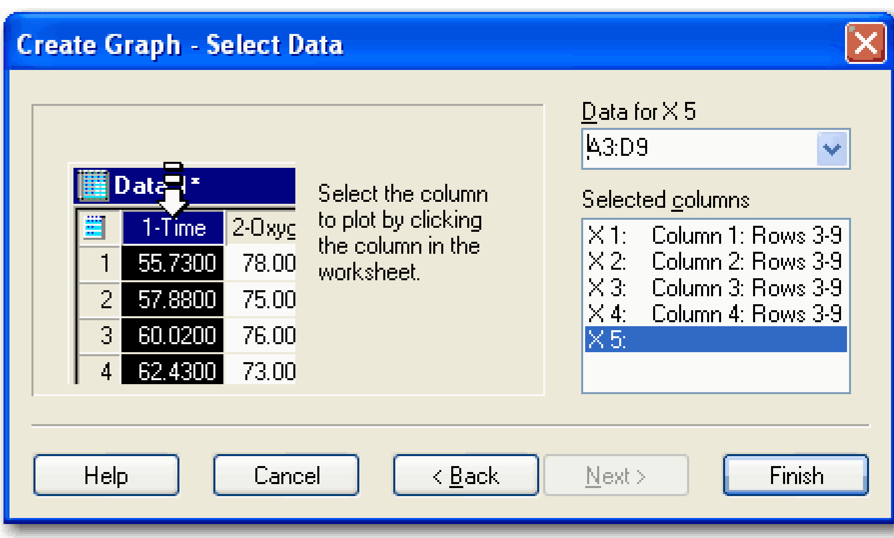
Figure 8. Selecting a Range of Data Using the rc Format



Excel Notation

You can also use Excel notation in the Graph Wizard. In Excel notation, the columns are alphabetized in lexicographic order and the rows are numbered. In this case, to specify a rectangular region you would again specify the upper left and lower right cells. For example, both A3:D9 and $A3:$D9 specify a region with the upper left cell in the first column, third row and the lower right cell as the fourth column, ninth row. Note that the separator is a colon. The letters are case insensitive.

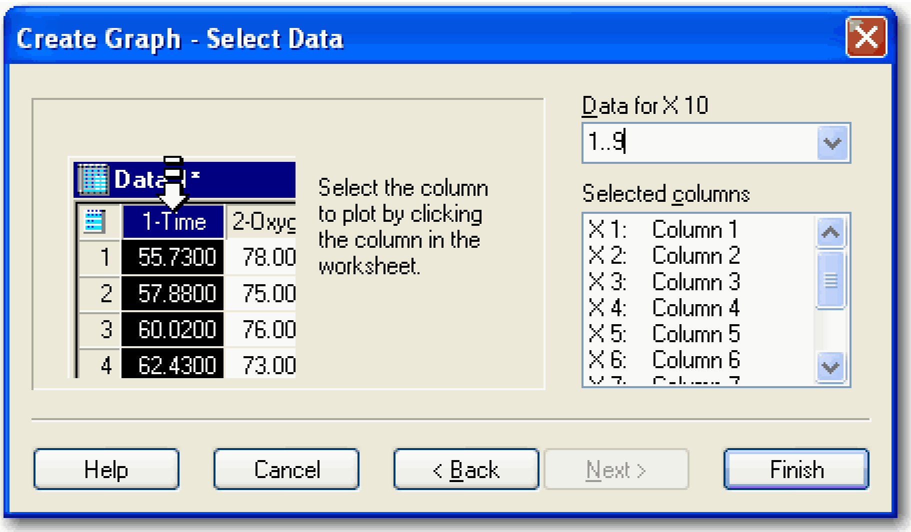
Figure 9. Selecting a Range of Data Using the Excel Format



Column Numbers Notation

You can make a selection of a consecutive group of entire columns by specifying the range of column indices. For example, to specify columns 1 through nine, type `1:9` or `1..9`.

Figure 10. Selecting a Range of Data Using the Column Numbers Format



Managing Plots

Use the the **Manage Plots** group on the **Graph Page** tab to make quick changes to graphs, such as adding or deleting plots, or adding plot labels and axes.

For more detailed graph edits, use the Graph Properties dialog box *(on page 89)*.

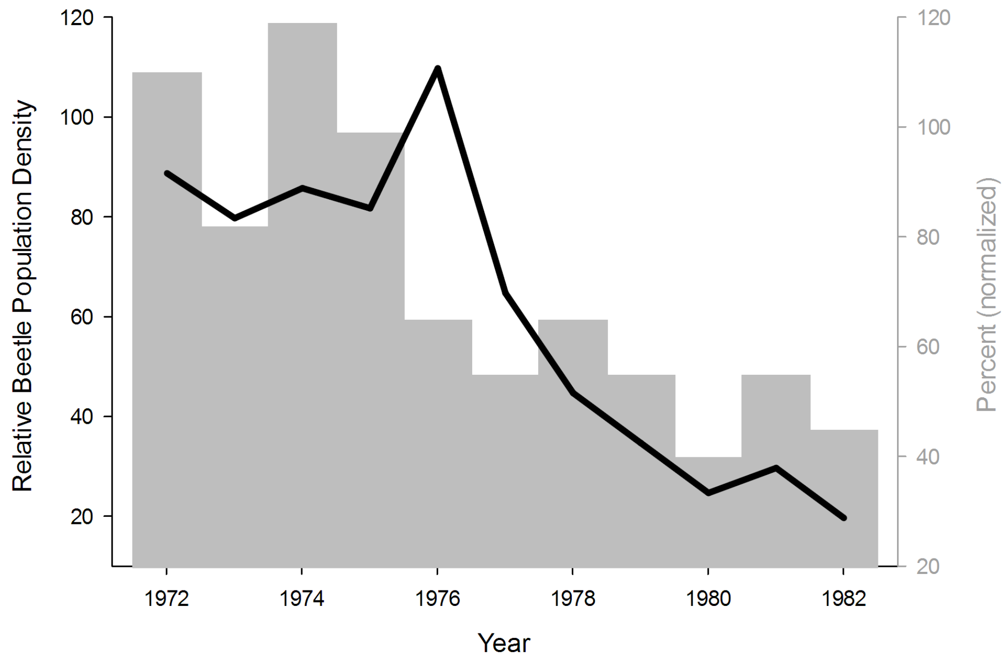
Adding Plots

Graphs can have multiple plots and plot types. Although most 2D graphs with multiple curves do not require more than one plot, if you want to mix plot types on a single graph you will need to create multiple plots.

Use multiple plots per graph rather than a single plot with many curves only if different plot types or styles are required (for example, placing a bar chart and a line plot, or a 3D scatter and mesh plot on a graph), if different data formats are required (such as XY and Y only for a scatter plot), or if a curve requires a different axis (scale, range, etc.).

2D graphs with multiple plots can also have multiple axes.

Figure 11. In this example of a graph with two plots, each plot has separate Y-axes.



To add another plot to a graph:

Fastpath:

Select the graph, right-click, then select **Add New Plot**.

1. Click the graph to modify. Small square handles surround the graph. Do not click a curve, or you will modify that curve instead.
2. Click **Add Plot** in the **Manage Graphs** group on the **Graph Page** tab.
   The **Graph Wizard** appears displaying all the graph types. The available styles and types for a new plot are limited depending on the other plot types and styles in the current graph; for example, you cannot add a Polar plot to a 2D Cartesian plot, or vice versa.

   Note:

   If the selected graph cannot accommodate the plot type or style that you want to add, the plot is created as a new graph. You can move the graph of the new plot over the original graph so that it appears to be in the same graph.

3. Select a **Graph Type** and click **Next**.
4. Select a **Data Format** and click **Next**.

5. Pick data either by clicking the corresponding column directly in the worksheet, or choosing the appropriate column from the data list. Use this method to pick X, Y, or Z data, R and theta data, and error bar data.

> **Tip:**
> If you make a mistake while picking data, click the wrong entry in the **Graph Wizard**, then choose the correct column from the worksheet. You can also clear a column assignment by double-clicking it in the **Selected Columns** list.

6. Repeat the process for every data column. When you have chosen the data appropriate for your style of plot, click **Back** to re-pick data columns, or if applicable, click **Next** to pick data for additional plots.
7. Click **Finish**.

Deleting Plots

The simplest way to delete plot is to select it on the graph and then press Delete. You can also delete plots using the **Manage Plots** group on the **Graph Page** tab.

1. Click **Delete Plot** in the **Manage Graphs** group on the **Graph Page** tab.
   The **More Plots** dialog box appears.
2. Select which plot you would like to delete from the list.
3. Click **Delete**.

Adding Axes

You can only create new pairs of X or Y axes if you have more than one plot on a graph and you want to scale these plots differently. For more information, see Modifying Axes, Tick Marks, and Grids *(on page 321)*.

Related information

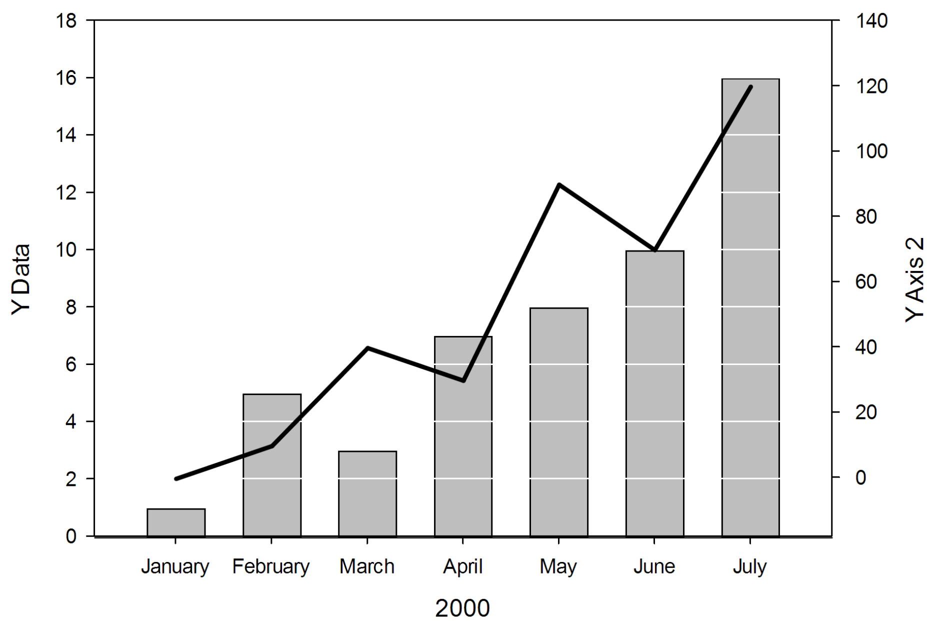
Modifying Axes, Tick Marks, and Grids *(on page 321)*

Creating Additional Axes for Multiple Plots

If you have more than one plot on a graph and want to use multiple axes, use the following steps to add additional axes.

To create an additional axis:

1. Click the **Graph Page** tab and then in the **Manage Graphs** group, click **Add Axis**.
   The **Graph Wizard** appears.
2. Select to create either a new X axis or Y axis for the specified plot.
3. Click **Next**.
4. Select which side of the graph to add the new axis. You can add the new axis to the left, right, top, or bottom of the graph. Selecting an Offset location moves the new axis slightly to the side, top, or bottom of the original axis.
5. Click **Finish** to add the new axis according to the specified settings. The New axis appears on the graph, and the plot re-scales to reflect the new axis.



Creating Multiple Axes for a Single Plot

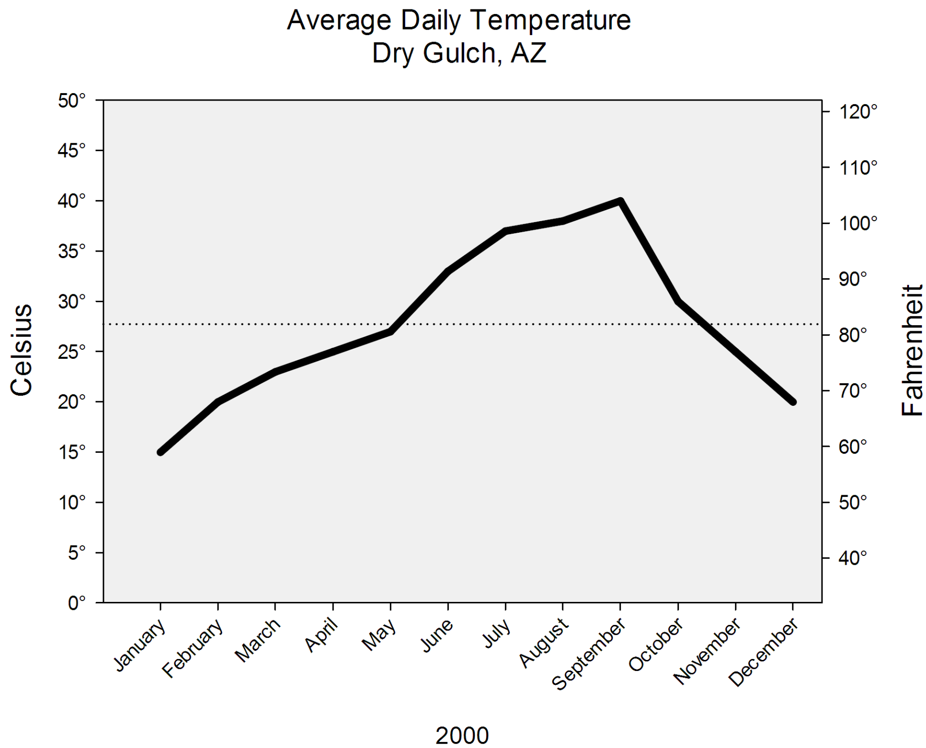
If you want to use two or more X or Y axes for a single plot (for example, to show two different units of measurement), first create a plot which graphs empty columns, then add an axis to the empty plot.

> **Tip:**
> The plot type does not matter, so long as it is a **2D Cartesian** plot.

To add an axis to the second plot:

1. Click the **Graph Page** tab and then in the **Manage Graphs** group, click **Add Axis**.
   The **Graph Wizard** appears.

2. Pick any data format.
3. Pick empty columns when prompted to select the data to plot.
4. Create an axis for this "dummy" plot at the desired location
5. Select the new axis, then use manual scaling to set the appropriate range and tick interval for the new axis. This scale is often a linear transformation of the opposite axis scale, for example, a Celsius scale to a Fahrenheit scale.



Modifying Plots

Use the Graph Wizard to experiment with graph styles and data formats to a plot you've already created.

You can make the following kinds of changes to a plot you've already created:

- Worksheet data
- Data format
- Graph style
- Graph type

To modify an existing plot:

1. Select the plot on the graph.
2. Click the **Graph Page** tab.
3. In the **Manage Plots** group, click **Modify Plot**.
   The **Select Data** panel of the **Graph Wizard** appears.
4. If you'd like to change the data format, click **Back** once to move to the **Data Format** panel.
5. Click **Back** a second time to change the graph style on the **Style** panel.
6. Click **Back** yet again to move to the **Type** panel where you can change the graph type.
7. Click **Next** to move to the ultimate step in the series of Graph Wizard panels to select a different column of data for the plot.

Picking Different Data for the Current Plot

To change data columns for an existing plot:

1. Click the plot to modify.
   Square handles appear over the data points for the clicked curve. Do not click the graph, or you will add a plot to the graph.
2. On the **Graph Page** tab, in the **Manage Plots** group, click **Modify Plot**.
3. In the **Graph Wizard**, under **Data Format**, select a data format, and click **Next**.
4. **If you don't change the data format for your graph,** your previous column choices appear under **Selected Columns**. To change column assignments, under **Selected Columns**, select the desired assignment, then under **Data For**, select the appropriate column from the worksheet or from the data list.
5. **If you change the data format for your graph,** a single data type is highlighted in the **Selected Columns** list. To pick data, either click the corresponding column directly in the worksheet, or choose the appropriate column from the **Data for** list. Use this method to pick X, Y, or Z data, R and theta data, and error bar data, if applicable.
6. Click **Finish** to close the **Graph Wizard** and view the changed graph.

Changing Graph Type and Style

Change plots using the Graph Wizard; however, once you have defined a plot style and type, the styles and types available for you to apply to the created plot are limited. If the plot you have selected cannot be changed to the plot type or style that you want, use the Graph Wizard to create another plot using the desired style and type.

To change graph type and style:

1. Click the plot to modify. Square handles appear over the data points for the clicked curve. Do not click the graph, or you will add a plot to the graph.
2. On the **Graph Page** tab, in the **Manage Plots** group, click **Modify Plot**.
3. **To change plot style,** in the **Graph Wizard** , click **Back** to view the **Graph Styles** list. Choose from the list of available styles then click **Next**.

4. **To change the plot type,** click **Back** twice to view the **Graph Types** list. Choose from the list of available graph types, then click **Next**.
5. If necessary, pick the data columns to plot again. Otherwise, click **Finish** to complete you plot type or style change.

Adding Plot Labels

Add labels to graphs either by calculating from the plot data or providing a column from the worksheet.

You can set your position relative to the graph object that you are labeling. The labels appear in the worksheet, set to an XY Scatter plot. From here, you can customize the label font through formatted text in the worksheet.

You can use Plot Labels on graphs created using the following data types:

- SingleX
- SingleColumn
- SingleXErr
- SingleY
- SingleYErr
- YXPair
- YXPairs
- CategoryXPair
- XYPair
- XYPairs
- CategoryYPair
- XYPairErr
- YXPairErr
- SingleXIndexed
- SingleYIndexed

To add plot labels:

1. Select the graph.
2. Click the **Graph Page** tab.
3. In the **Manage Plots** group, click **Plot Labels**.

   The **Label plot** dialog box appears.

   Here you decide which plot in your selected graph to add the labels. You can also choose the labels' source, which can be either an existing column of text labels from the worksheet or the plot data.

   The plot data generates labels from the graph data. They appear formatted as X; X, Y; Y; Y, X. The text for these labels appears in the worksheet. You can edit the labels and format the text using Format Text *(on page 186)*.

Related information

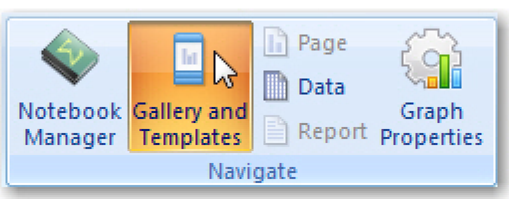
Label Symbols *(on page 415)*

Using the Graph Style Gallery

Use the **Graph Style Gallery** to create a custom graph from a predefined graph style. You can create this style yourself, or use one of the many existing templates. When creating a custom graph style, you save all graph, plot, and axes attributes, including graph size and position. Then you can quickly use these attributes to create future graphs. All you supply is the data, and the Graph Style Gallery formats the rest.

To open the Graph Style Gallery:

On the **Home** tab, in the **Navigate** group, click **Gallery and Templates**.



Each graph style appears as a thumbnail preview in the Graph Style Gallery. You can create new graphs by choosing one of the styles from the window. You can either double-click a graph or click **Create Graph** to create a graph. The graph then appears in a location defined by the graph style. This section discusses:

- Adding styles to the Graph Style Gallery.
- Applying graph styles to pages.
- Editing graphs in the Graph Style Gallery.
- Creating Graph Style Gallery graphs from the Graph Wizard.

Applying Graph Styles to Pages

Use the **Graph Style Gallery** to quickly apply your own custom graph styles to data.

To apply a graph style:

1. View the **Graph Style Gallery**.
2. Double-click the graph style you want to use.
   The **Graph Wizard - Create Graph** panel appears.
3. In the **Graph Wizard**, select the worksheet columns you want to use for the plot.
4. Click **Finish** to create the plot.

Editing Graphs in the Graph Style Gallery

1. Select the graph to edit in the **Graph Style Gallery**.
2. Right-click, and from the shortcut menu click **Edit**.
   The graph appears in a graph page.
3. Modify the graph using Graph Properties. For more information, see Modifying Graphs Using Graph Properties *(on page 89)*.
4. Close the graph page.
   The new style is saved in the **Graph Style Gallery**.

Adding Styles to the Graph Style Gallery

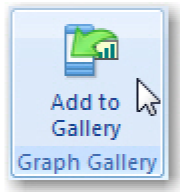
After creating and formatting a graph, you can save its style in the Graph Style Gallery, and later apply that style to future SigmaPlot graphs.

1. To add a graph style or object to the Graph Style Gallery:

   a. Open the graph that you wish to add to the **Graph Style Gallery**.

   b. Select the graph.

   c. On the **Create Graph** tab, in the **Graph Gallery** group, click **Add to Gallery**.



d. Right-click and on the shortcut menu click **Add Graph**. The graph style appears in the Gallery.

e. You can also drag and drop it into the **Graph Style Gallery** window.
A thumbnail of the graph appears in the Graph Style Gallery. The graph title appears as the graph style's name.

2. To use the right-click shortcut menu:

a. Select the graph on the page, and then click inside the **Graph Style Gallery**.

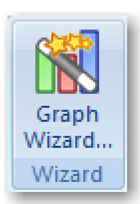
b. Right-click and on the shortcut menu click **Add Graph**.
The graph style appears in the Gallery.

Creating Graph Style Gallery Graphs from the Graph Wizard

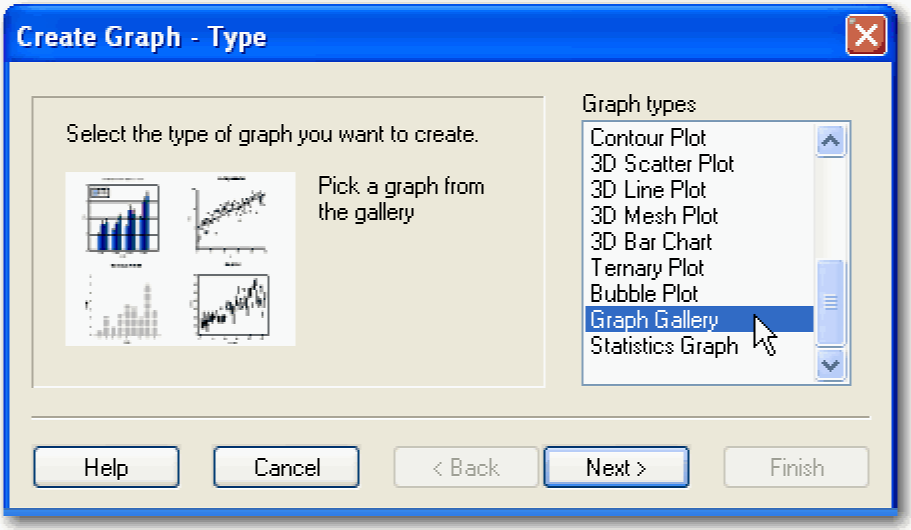
You can use the **Graph Wizard** in conjunction with the **Graph Style Gallery** to create graphs by selecting **Graph Gallery** as a graph type in the **Graph Wizard**.

To create a Graph Style Gallery graph from the Graph Wizard:

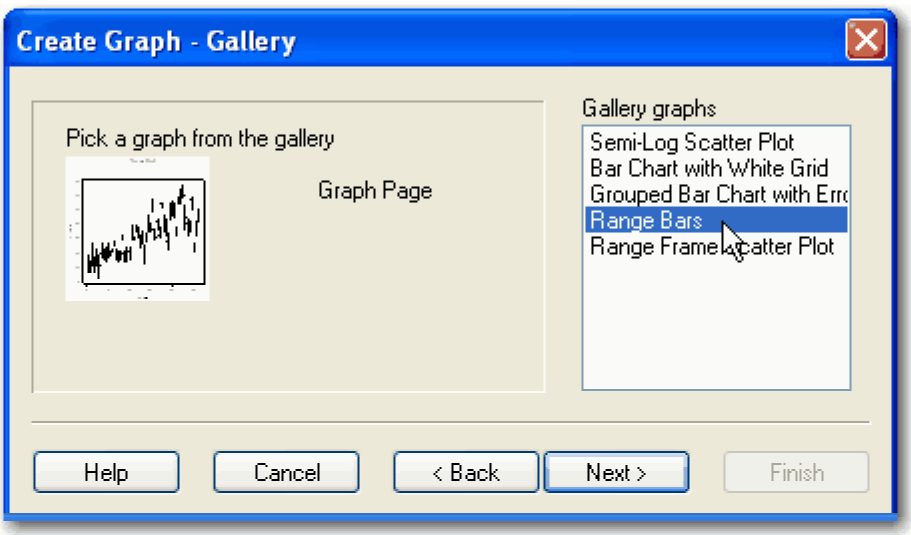
1. On the **Create Graph** tab, in the **Wizard** group, click **Graph Wizard**.



2. Click **Finish** to create the graph. A graph appears on the page using the applied Gallery graph style.
3. In the **Graph Wizard**, under **Graph Types**, select **Graph Gallery**, and click **Next**.

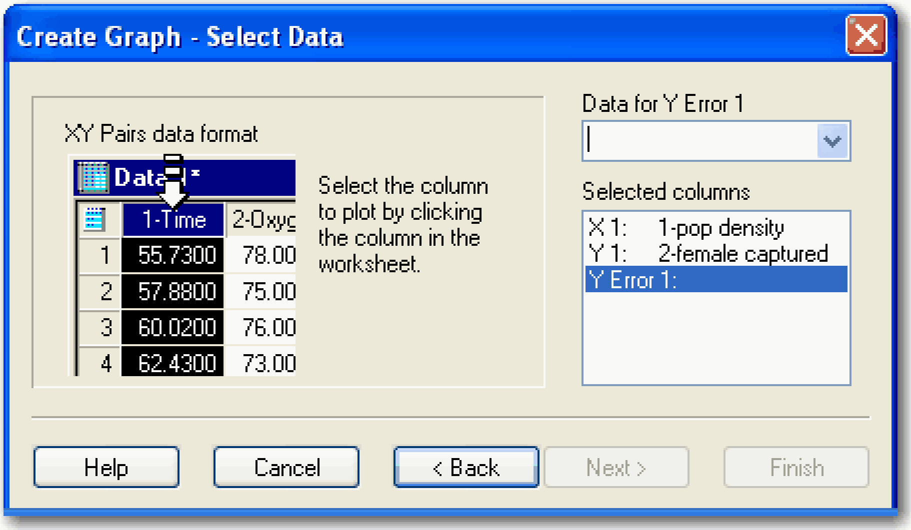


The **Create Graph - Gallery** panel of the **Graph Wizard** appears. All graphs that appear in the Gallery graphs list are also in the Graph Styles Gallery.



4. Under **Gallery graphs**, select the graph type that you want to apply to your data, and click **Next**.

The **Create Graph - Select Data** panel of the **Graph Wizard** appears.



5. Under **Data for**, select the worksheet columns to plot. If you make a mistake while selecting data, select the correct column in the **Selected Columns** list.
6. Click **Finish** to create the graph.

   A graph appears on the page using the applied Gallery graph style.

Modifying Graphs Using Graph Properties

For many graph modifications, all you really need to do is click any object on the graph, and the available options are immediately visible to you in a pop up window. But for the most part, for any type of graph modification, double-click the object on the graph (the axis, the line, the symbol, area fill, and so on) and the Graph Properties dialog box appears with the relevant options already in view.

Use **Graph Properties** to make most graph modifications. The choices you make are reflected immediately in Graph Properties. To undo a change, press Ctrl + Z.

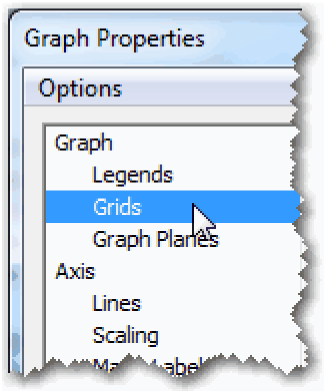
Modifying Plots and Axes

All you need to do to modify a plot or axis on any graph page is double-click it (the same for modifying any object on a graph page). The available options immediately appear in **Graph Properties**.

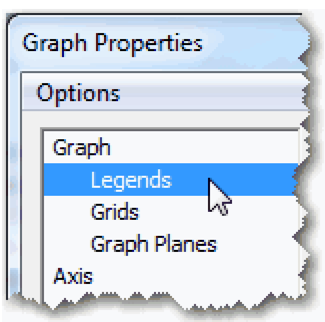
Modifying Grids and Planes, Titles, and Legends

Grids are only available for 3D plots.

To modify grids, double-click the graph to open **Graph Properties**. In the **Property** list, select: **Graphs > Grids**.



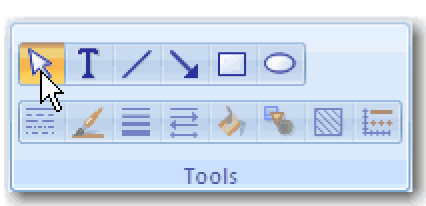
To hide or show graph titles and automatic legends, to hide or show plots, and to make modifications to automatic legends, in the **Property** list of **Graph Properties**, select: **Graph > Legends**.



Selecting a Graph or a Plot

To select a graph or plot:

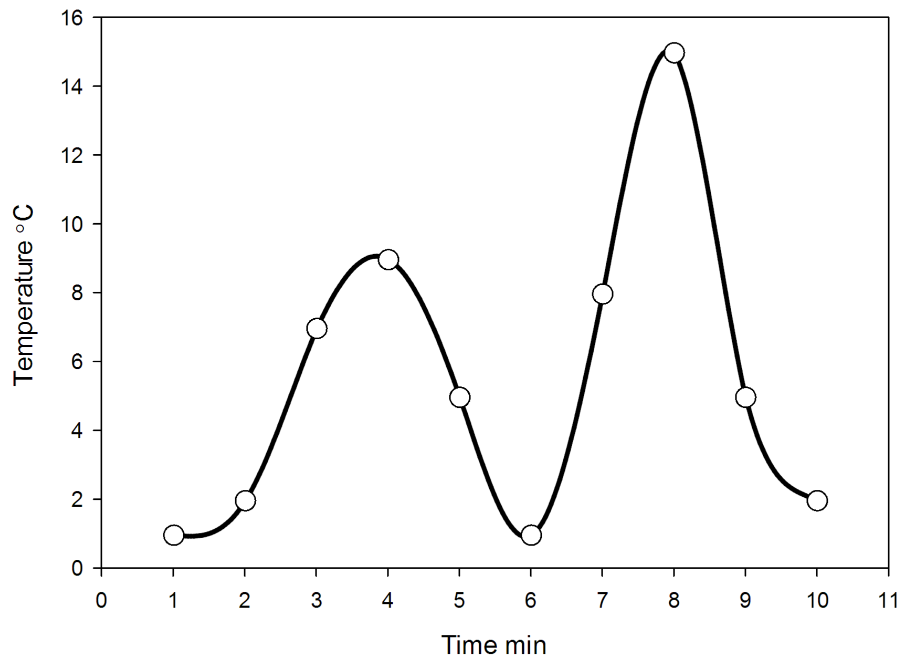
1. View the page window.
2. On the **Graph Page** tab, in the **Tools** group, click the **Select Object** button.



3. Place the pointer over the desired graph or plot and click.

A selected graph is surrounded by small handles.

Figure 12. Small handles surround selected graphs.



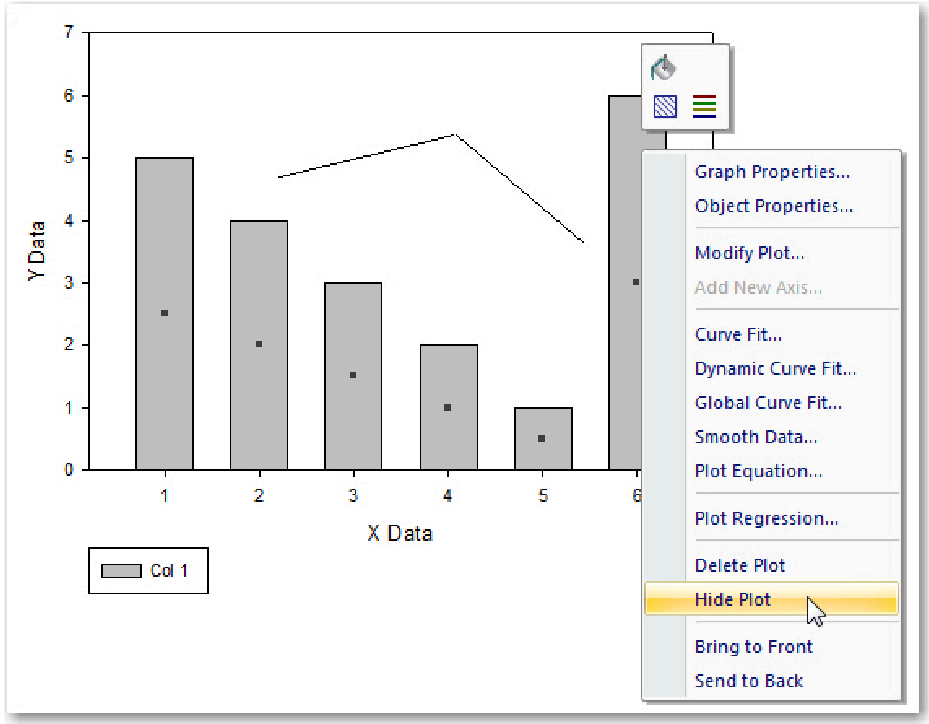
Hiding, Showing, and Deleting Plots

Occasionally, you may want to remove a plot from a graph without deleting it. You can hide plots from view without deleting them by using the right-click shortcut menu.

1. To hide a plot:

   a. Right-click the plot and then click **Hide**.
   The plot is hidden, but not removed.

Figure 13. You can use the right-click shortcut menu to hide graphs.



2. To show a hidden plot:
    a. Double-click the graph to open **Graph Properties**.
    b. Clear a check box to hide a plot from view, or select it to show the plot.
3. To delete a plot:
    a. Select the plot.
    b. Press Delete.

Sampling Fewer Data Points

If you have a graph with a large number of data points, you can plot only a portion of the column(s) or sample only a portion of the data from the column. This is useful if you are interested only in graphing part of the data, or if you want to increase drawing speed while working on the graph.

To plot only a portion of your data:

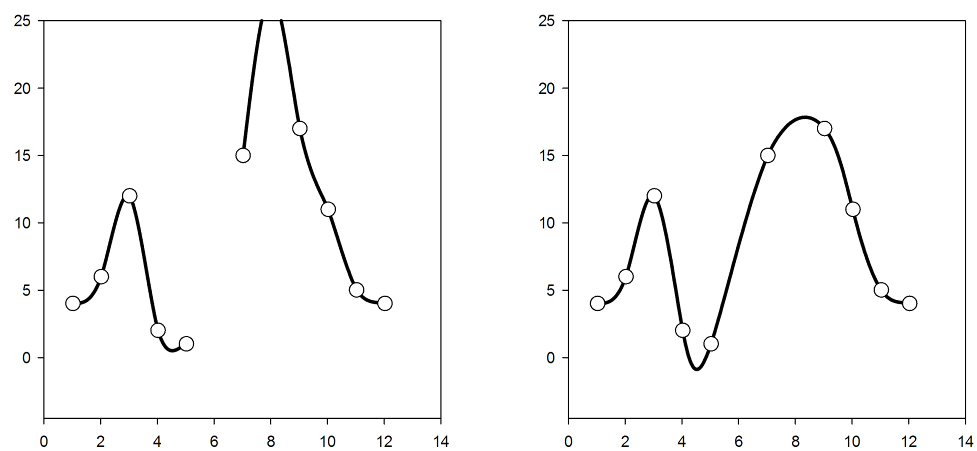
1. Double-click the graph.
   The **Graph Properties** dialog box appears.
2. In the **Properties** list select: **Plot > Data**

3. **To plot only a portion of your data,** under **Data sampling**, select **Only rows**, and then enter the range to plot.
4. **To sample the column rows by a specified increment,** select **by** and type a number. Typing a 2 samples every other row and reduces the number of rows plotted by 50%, typing a 3 samples every third row, and so on. You can also use the **by** list to select a number of rows plotted.

Plotting Missing and Out of Axis Range Data Points

You can choose to either plot or ignore bad points. Bad points are either missing values, or data that lie outside the axis ranges.

Figure 14. Example of Graphs Plotting Bad Data Points



The graph on the left plots both a missing data point and out-of-range data point. The graph on the right ignores both missing and out of range points.

To ignore missing and out of-range points:

1. Double-click the graph.
   The **Graph Properties** dialog box appears.
2. In the **Properties** list select:**Plot > Data**
3. Select the desired plot from the **Plot** drop-down list.
4. **To plot data without missing values,** under **Ignore**, select **Missing values**. To plot missing values, clear the option.
5. **To plot data without out of range values,** under **Ignore**, select **Out of range values**. To plot out of range values, clear the option.

Changing Symbol Type and Other Symbol Options

You can specify the symbol type used either for the symbols in a single curve, or for all the curves in a plot. The default is to use the same symbol for a single curve and increment symbols for multiple curves.

You can only modify symbols. Plots that normally use symbols are scatter plots, line plots, line/scatter plots, bubble plots, polar plots, box plots, and 3D scatter plots, 3D trajectory plots, and ternary plots.

Bubble plots use circles as the default symbol shape. If you choose a different symbol shape, you must change the transform function used to translate area to diameter.

You cannot increment Symbols for single curves, unless there is only one curve within a plot.

Arranging Data for Graphs

For most graph types, unless you are creating a pre-formatted worksheet from the Start Up Screen, the Graph Wizard prompts you to select a data format. Your selection determines how your worksheet data is associated with points on the graph. For example, an XY Pair data format means that graph uses two columns; one column corresponds to the X-axis and the other corresponds to the Y-axis. In the XY, Many Z data format, one column corresponds to the X-axis data, another column corresponds to the Y-axis, and the remaining columns correspond to Z-axis data.

Arranging Data for 2D Plots

Organize data for 2D graphs by columns. Place data for the X values of a graph in a single column, and place data for the corresponding Y values in another column.

Arranging Data for a Pie Chart

To organize data for a pie chart, place data in a single worksheet column.

Arranging Category Data

Use *Category Data* formats (indexed data) if your data is organized row wise by categories with corresponding data, as is often the default data organization for both statistics data tables and databases. Using this format, you can plot data files from other statistical packages, such as SigmaStat or SYSTAT, without having to divide the data into groups.

Figure 15. In this worksheet, the data is arranged for an XY Categories data format. The "Animals" column is what you would select as the "category" column in the Graph Wizard.

	1-Animals	2-Dose Response	3-Heat	4	5
1	Dogs	2.30	100.00		
2	Dogs	3.00	200.00		
3	Dogs	5.23	300.00		
4	Dogs	4.78	400.00		
5	Dogs	4.32	200.00		
6	Cats	2.30	400.00		
7	Cats	4.75	200.00		
8	Cats	4.12	100.00		
9	Cats	4.80	350.00		
10					
11					

The Category Data format is available when creating summary plots. Graph types and styles that can use a category data format are:

- **Scatter Plot.** Multiple Scatter; Multiple Regression
- **Line Plot.** Multiple Straight Lines; Multiple Spline Curves; Multiple Vertical Step Plot; Multiple Horizontal Step Plot; Multiple Vertical Midpoint Step Plot; Multiple Horizontal Midpoint Step Plot

Arranging Radar Plot Data

To organize data for a radar plot, place the label (if used) in one column, and then each series in a separate column.

Arranging Data for Plots with Error Bars

Arranging Data for Column Averaged Error Bar Plots. Certain graph styles plot data by representing the mean of an entire column as a single data point. In these cases, place the values you want represented as a single X or Y value into one column.

Arranging Data for Asymmetric Error Bar Plots. Asymmetric error bar plots use two columns as the error bar source from which you can independently control the values of error bars. Place the values you want to represent the error bars to the right of the plotted column.

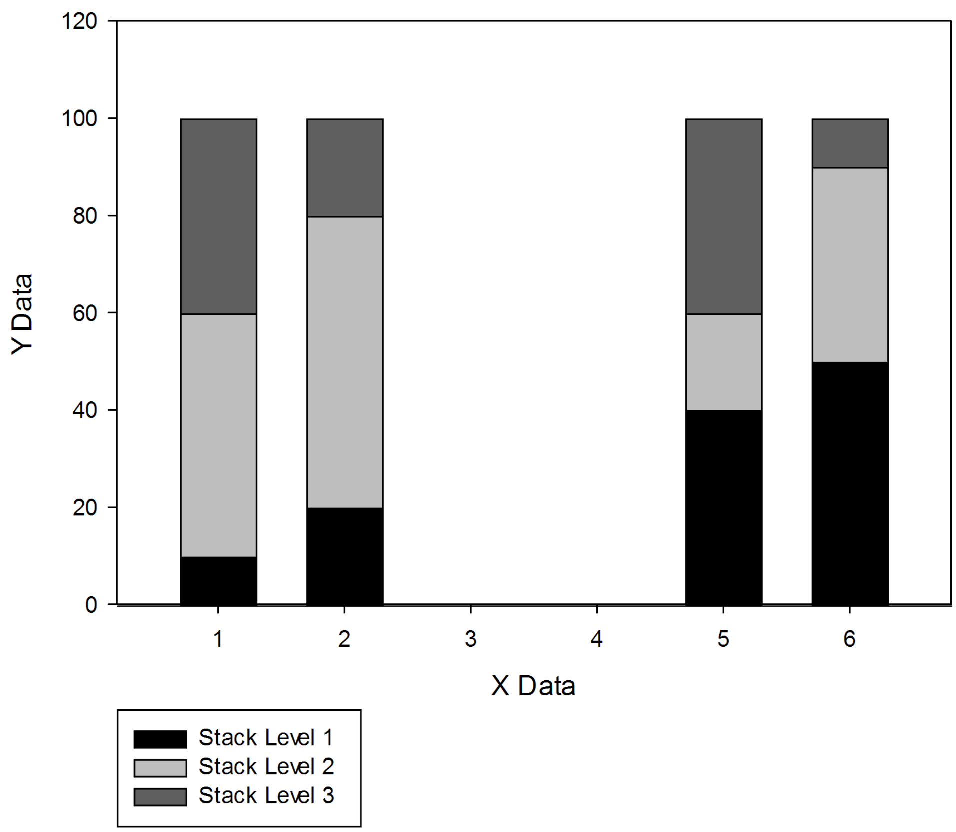
Arranging Data Using Column Means. Plots the average of an entire worksheet column as a single data point, then uses the column statistics to compute error bars, as specified by the Error Calculation.

Arranging Data Using the Column Median. Plots the median of an entire worksheet column as a single data point, then uses the column statistics to compute error bars, as specified by the Error Calculation.

Arranging Data for a Stacked Bar Chart

In a *stacked bar chart* the bars appear on top of each other. The *stack level* corresponds to the location of the stack in the bar. Its *stack level value* corresponds to the height of the bar at a specific stack value.

X Many Y Data Format. This consists of one X column and an *n* number of stack level value (Y) columns. A stack level value column consists of numbers that correspond to the heights of the bars for the specific stack level. The following graph has four stacks, each with three stack levels.



Its corresponding worksheet has three stack level value columns. Each column contains four rows.

The X values are in the first column. The second column, *Stack Level 1*, contains the bar heights for the first stack level. This appears as the first bar in each stack, in black. The bar heights for the second and third stacks appear the third and fourth columns, *Stack Level 2* and *Stack Level 3*. The values in the Y rows are the bar heights for each stack. In this example, because the values for each row (*Stack Level 1* through *Stack Level 3*) add up to 100, the height of each stack in the graph will also be 100.

Arranging Data for a Vector Plot

Vector plots always use four columns of data. You can create vector plots using one of two data formats:

- **XYXY.** This data format uses an XY column pair for the vector start point and an XY column pair for the vector end point.
- **XYAM.** This data format uses an XY column pair for the vector start point, and then one data column for the vector angle, and then another column for the vector magnitude.

Using the Same Column for Multiple Curves (Single X or Y vs. Many Y or X)

SigmaPlot can graph many curves using the same X or Y data column. There is no need to duplicate a column that is used for more than one curve; for example, enter the X data into only one column, and enter the corresponding Y data into as many columns as you have curves. Order and length of columns does not matter.

Using Row Numbers for X or Y Values (Single X; Single Y; Many X; or Many Y)

SigmaPlot can also graph data as only X or Y values, and use the row numbers of the columns as the corresponding Y or X coordinates. If you want to graph data as only X or Y values, enter the data for each plot into a column, and do not enter data for corresponding coordinates.

Using an XY Pair Format for a Single Curve

If the graph you are creating uses only one set of X and Y values, enter all X data in one column, and all corresponding Y data in another column. Depending on the setting, these columns do not need to be adjacent or the same length (missing values are ignored).

Using an XY Pair Format for Multiple Curves

If the graph style you are creating plots more than one curve, place as many additional X and Y values in worksheet columns as you want to plot. Enter X and Y data in the worksheet in consecutive columns, or in any order you want.

Arranging Data for Polar Plots

Data for polar plots can be entered in either one of two ways:

- R, ϴ values
- X,Y coordinates

Data for Radial and Angular Values (R, Theta)

To arrange data using ϴ (angular) and R (radial) values, enter all ϴ values in one column, and enter the corresponding R values in another column. Data is plotted as ϴ versus R, which is similar to X,Y plots in organization, but differs from X,Y plots in that R is usually the dependent variable.

Using X,Y Values for Polar Plots

Polar plot X,Y data is arranged the same as 2D plot X,Y data, with all X values in one column, and all Y values in another column; however, polar plots are plotted as R,ϴ pairs defined as:

and

where *R* is the radius, and ϴ is the angle of the data point from the origin.

Data for Multiple Curves

Since SigmaPlot can graph more than one curve per plot, place as many additional ϴ, R values, or X,Y coordinates, as you want to plot in worksheet columns.

Using Data from One Column for Multiple Curves

SigmaPlot can also graph many curves using the same column as the ϴ or R data (or, X or Y data). There is no need to duplicate a column that is used for more than one plot; for example, enter the ϴ data into only one column, and enter the corresponding R or dependent data into as many columns as needed.

Arranging Data for a Ternary Graph

Data for ternary plots can be XYZ data in three separate columns or SigmaPlot can extrapolate a third column from data pairs in two columns. Ternary graphs must have at least one single or multiple curve plot, but can hold many more plots, each with a different style and data format. If your raw values do not add up to 100% or 1, SigmaPlot can convert them to normalized ternary data. If you have XY, YZ, or YZ pair data, SigmaPlot can compute the third-column values shown in the resulting graph.

Data for a Single Curve Plot (Ternary Triplets)

If you are creating a graph with a single curve plot using only one set of XYZ values whose sum is 100% or 1, enter all X data in one column, all Y data in another column, and the corresponding Z data in another column. The columns do not have to be adjacent to one another, but they must be the same length. Ternary triplet data should always add up to 100% or 1.

Data for a Multiple Curve Plot (Ternary Triplets)

If you are creating a graph with a multiple-curve plot using multiple sets of XYZ values where the sum of each set is 100% or 1, enter into worksheet columns as many additional ternary triplet data sets as you want to plot. Each set of ternary triplet data is a separate plot-curve. All ternary triplet data sets should add up to 100% or 1.

Figure 16. Multiple Columns of Triplet Percentage Data for a Ternary Plot

Data 1*

	1-Plot 1 X Data	2-Plot 1 Y Data	3-Plot 1 Z Data	4	5	6
1	0.00	11.00	89.00	25.00	0.00	75.00
2	17.00	10.00	73.00	24.00	15.00	61.00
3	34.00	10.00	56.00	24.00	30.00	46.00
4	50.00	10.00	40.00	24.00	46.00	30.00
5	67.00	9.00	24.00	25.00	60.00	15.00
6	92.00	8.00	0.00	27.00	73.00	0.00
7						

Data for a Single or Multiple-Curve Plot (Ternary XY, YZ, or XZ Pairs)

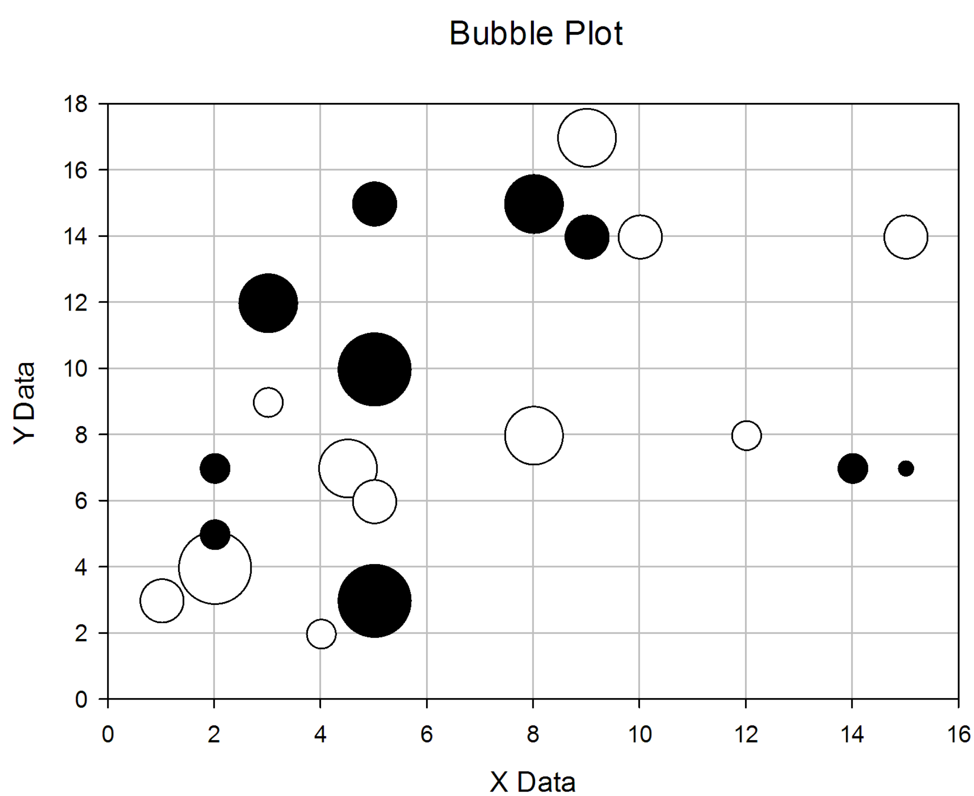
If you are creating a graph with a single or multiple curve plot using XY, YZ, or XZ pairs, enter all X, Y, or Z data in one column, and the corresponding X, Y, or Z pair values in another column. As long as all data pairs use a percentage or unitary scale, SigmaPlot will compute the third-column data shown in the resulting graph.

SigmaPlot computes third column data for plotting only. Computed third-column data is not displayed in the worksheet.

Arranging Data for Bubble Plots

Data for bubble plots can either be X, Y data in two separate columns or single X or single Y data in one column. In both cases, an additional column is needed to indicate bubble size values. Since the bubble size column corresponds to symbol diameter, you must convert the data for your third variable to diameters.

Bubble plots must have at least one plot, but can hold many more plots using different data formats if appropriate. The bubble plot type has available only the default scatter style. You can change the symbol type. However, if you use something other than a circle you will need a different equation to transform area to diameter.



Using X, Y Values for Bubble Plots

Bubble plot X, Y data is arranged in the same way as other 2D plot X, Y data, with all X values in one column and all Y values in another.

Related Topics

Bubble Plots *(on page 279)*

Data for Bubble Size

SigmaPlot can graph bubble plots using XY pair, Single Y, Single X, and bubble size data. Bubble size values must be entered in a separate column. Each value corresponds to the diameter of the symbol, in whatever page units are being used. If you want bubble size to correspond to area data, you must convert your area data to diameters before creating the bubble plot.

Converting Area Data to Diameters

If you want your bubble plot to display area data, you must run this transform where area is the source column number and the diameter is the results column number. This transform is derived from the formula for the area of a circle.

To convert your area data into diameters:

1. Click the **Analysis** tab, and then in the **Transform**group, click **User-Defined**.
2. In the **User-Defined Transform** dialog box, type the transform function as follows:

   ```
   pi=3.14159265359 col(diameter)=sqrt(col(area)*factor/pi)
   ```

   where diameter is the column number for your diameter data, area is the column number for your original data to be represented by area, and factor is some number to increase or decrease the magnitude of your data to a reasonable range.

   > **Tip:**
   >
   > Reduce the diameters of your symbols to a reasonable size before plotting them.

3. Click **Run**.

   Your new data appears in the worksheet. If you change the symbol shape, you must use a different equation to transform area data.

Arranging Data for 3D Graphs

Organize data for SigmaPlot graphs by column. Typically, data for contour plots and 3D graphs is composed of X, Y, and Z value columns, or one or more Z columns and optional X and Y columns. 3D bar charts, scatter plots, and line plots can use any three columns as XYZ data.

Important:
If multiple Z columns are plotted, they all must be next to each other. The X and Y columns can be located anywhere.

Data for 3D Bar Charts, 3D Scatter Plots, and 3D Line Plots

Arrange data for 3D bar charts, scatter plots, and line plots either as XYZ triplet data, multiple columns of Z data, or as a single column for Y values, a single column for X values, and multiple columns for Z values. For each of these graph types, the data in each row is graphed as a data point. For bar charts, each column of Z data is plotted as a row parallel to either the X axis, with Y values as the constants.

If you are formatting XYZ triplet data, you also can use one of the multiple Z column formats designed for 3D mesh plots.

Data for Contour and Mesh Plots

A regular rectangular mesh plot requires XYZ coordinates for each intersection of a rectangular mesh. The data for a contour or mesh plot can be in the form of either a regular rectangular mesh or an irregular mesh. If the data is a regular rectangular mesh it is graphed as-is without any modification. If it is an irregular mesh then it is interpolated to form a regular rectangular mesh and then graphed.

	Y1	Y2	Y3	Y4
X1	Z1	Z4	Z7	Z10
X2	Z2	Z5	Z8	Z11
X3	Z3	Z6	Z9	Z12

The arrangement of this data for the three possible methods of picking columns to plot are described in the following sections.

X, Y, and Z Data in Three Columns. To plot three columns as the X, Y, and Z values of a contour or mesh plot, the data must be in long form mesh format. This format assigns the proper Z value to each X and Y point in the mesh, in the required order.

For example, for the table of X, Y, and Z values shown above, the three column mesh format must be arranged in the worksheet as:

X data	Y data	Z data
X1	Y1	Z1
X2	Y1	Z2
X3	Y1	Z3
X1	Y2	Z4
X2	Y2	Z5
X3	Y2	Z6
X1	Y3	Z7
X2	Y3	Z8
X3	Y3	Z9
X1	Y4	Z10
X2	Y4	Z11
X3	Y4	Z12

This arrangement places the XYZ data point coordinate values in the required order. The XYZ columns must be the same length.

X and Y Columns vs. Many Z Columns. You can also place the X and Y data in single columns, then place the corresponding Z data in many continuous columns. This method may work best if you have XYZ data displayed in a table, or if you have irregularly incremented X or Y values.

To use this option, you should have as many Z columns as you have Y rows, and the Z columns should be the same length as the X column.

X data	Y data	Z data			
X1	Y1	Z1	Z4	Z7	Z10
X2	Y2	Z2	Z5	Z8	Z11
X3	Y3	Z3	Z6	Z9	Z12
	Y4				

The data in the first Z column is assigned to the first Y value, the data in the second Z column to the second Y value, etc.

The data in each row of the X column is assigned as the X value for the data in the same row in the Z columns.

You can use columns of uneven length. Extra X, Y, or Z values created by uneven columns are not plotted, as mesh plots cannot graph missing values.

Z Data vs. Row and Column Numbers: You can also plot columns as Z values versus the cell columns and row numbers as the X and Y values.

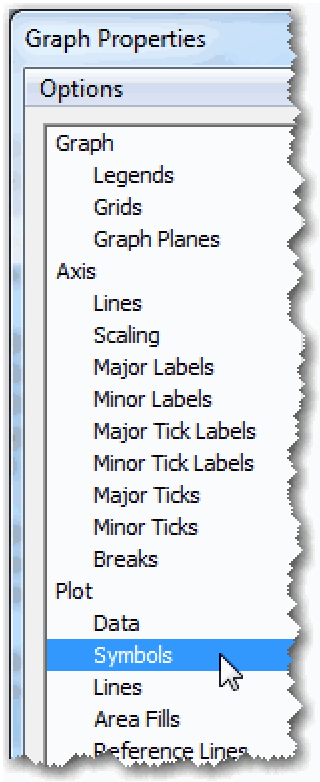
This is the appropriate column assignment option to use: for mesh plots and 3D Bar Charts where X and Y values are evenly and equally spaced; for example, when graphing pixel intensity data for an image.

All data is assigned as a Z value, and the Z columns must be contiguous. To use this format for a mesh plot, no special data arrangement is required other than equal column length. The rows and columns of the cells can be used as either the X or Y values.

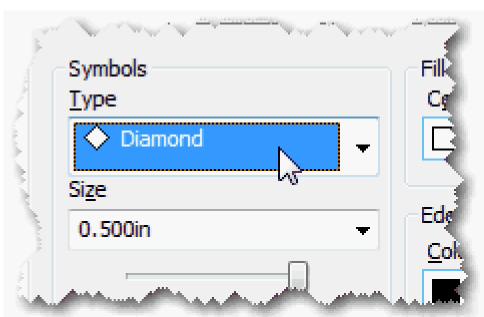
Changing Symbol Type, Size, and Color

To change symbol attributes:

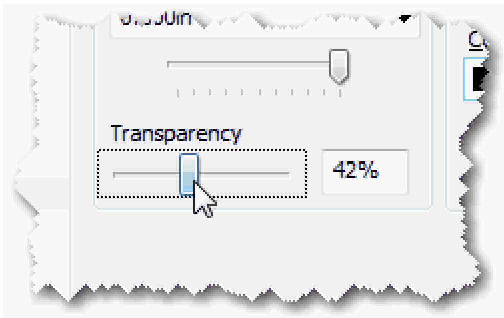
1. Double-click a symbol on the graph page.
   The **Graph Properties** dialog box appears.
2. In the **Properties** list, select: **Plot > Symbols**.



3. **To change the symbol type for the selected plot,** under **Symbols**, select a symbol type from the **Type** drop-down list, or choose to increment symbols using the one of the symbol schemes.



4. **To change the size of the symbol,** type a new value in the **Size** box. By default, all symbols in a plot are the same size. Use symbols of different sizes by entering symbol sizes in a worksheet column, then selecting the column from the **Size**drop-down list.
5. **To make symbols transparent,** move the **Transparency** slider.



6. **To change the fill color of symbols for the selected plot,** under **Fill color**, select a color or an incrementing scheme from the **Color** drop-down list.
7. **To turn off symbol fills,** select **(None)**.
8. Select **(Custom)** to open the **Color** dialog box to create or choose a custom color. For more information, see Using Custom Colors and Incrementing Schemes *(on page 199)*.

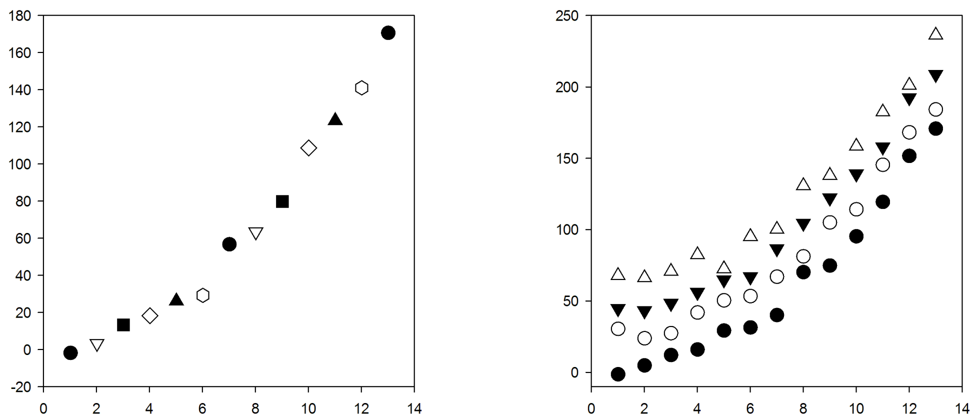
> **Tip:**
> Hollow Symbols are symbols that use **(None)** as the fill color. They are hollow, that is, they are composed of the edge lines only. Lines, error bars, and graph background colors all show through unfilled symbols. This is useful if you have many overlapping data points.

9. **To change the edge color of symbols,** under **Edge**, select a color from the **Color** drop-down list. To turn off symbol edge color, select **(none)**.
10. **To control the color of symbol dots and crosshairs,** or of text used as symbols, use the **Color** drop-down list under **Edge**. If a symbol is filled with black and has a black edge, then dots and crosshairs automatically default to white.
11. **To change the thickness of the symbol edge,** move the **Thickness** slider, or type a new value.

Automatically Incrementing Symbols

When incrementing symbols automatically, symbol types are assigned to curves (or points, if the plot has only one curve) in the same order as the column pairs listed in the Graph Wizard. SigmaPlot increments symbols according to the selected scheme.

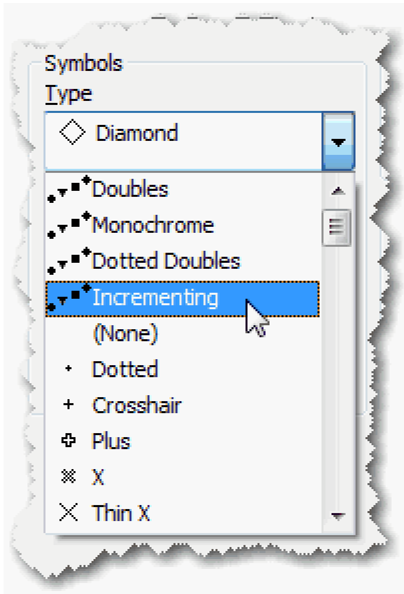
Figure 17. Both graphs use the Doubles symbol scheme and the Black and White color scheme. The first graph has only one curve; the second has four.



Symbol types and colors appear on the curves of the plot in the same order as the symbol types and colors in the right-click pop-up menus of the incrementing option.

To automatically increment symbols:

1. Double-click a symbol on the graph page.
   The **Graph Properties** dialog box appears.
2. In the **Properties** list, select: **Plot > Symbols**.
3. **To increment symbol types and fill and edge colors automatically,** under **Symbols**, from the **Type**, **Fill Color**, and **Color** lists, select a symbol scheme.



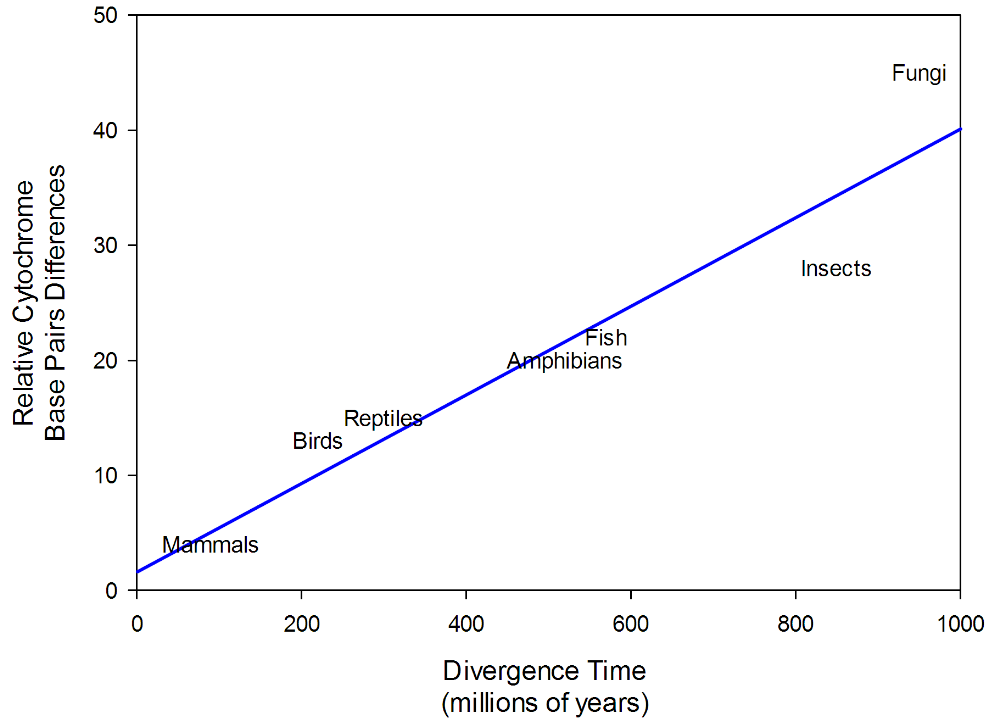
Note:

Increment schemes do not include (None) as a symbol type.

Using Characters and Text as Symbols

You can use numbers, characters, and text as symbols by entering them in a worksheet column and specifying the column in **Graph Properties**.

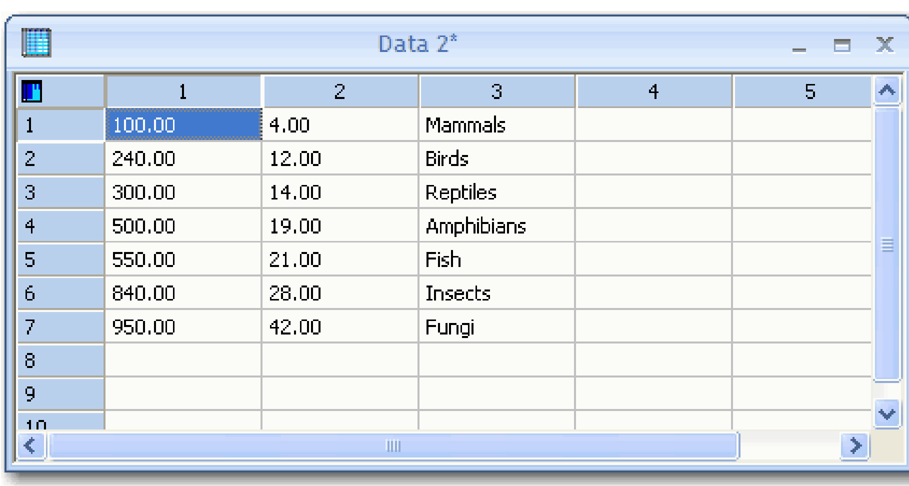
Figure 18. Using Text from a Worksheet Column as Plot Symbols



To specify characters as symbols:

1. Enter the text you want to use as symbols in a worksheet column in the order you want the curve(s) to use them. To use numeric values as symbols, add a space after each value in the worksheet. You can assign the numbers that appear aligned to the left as symbols.

Figure 19. Example of Worksheet with Plot Symbol Text Entered in Column 3



Data 2*

	1	2	3	4	5
1	100.00	4.00	Mammals		
2	240.00	12.00	Birds		
3	300.00	14.00	Reptiles		
4	500.00	19.00	Amphibians		
5	550.00	21.00	Fish		
6	840.00	28.00	Insects		
7	950.00	42.00	Fungi		
8					
9					
10					

You can use all the non-keyboard characters available for the default font. To view and access these characters, you can use the Windows Character Map utility. The *Windows Help and Support* also lists these special characters, along with the keystrokes required to enter them.

2. View the graph page.
3. Double-click the plot on which you want to use text symbols.
   The **Graph Properties** dialog box appears.
4. In the **Properties** list, select: **Plot > Symbols**.
5. Under **Symbols**, select the column that contains the text or numeric values you want to use as symbols from the **Type** drop-down list.

> **Note:**
> The column option does not appear in the **Type** list unless text or symbols are entered in a worksheet column.

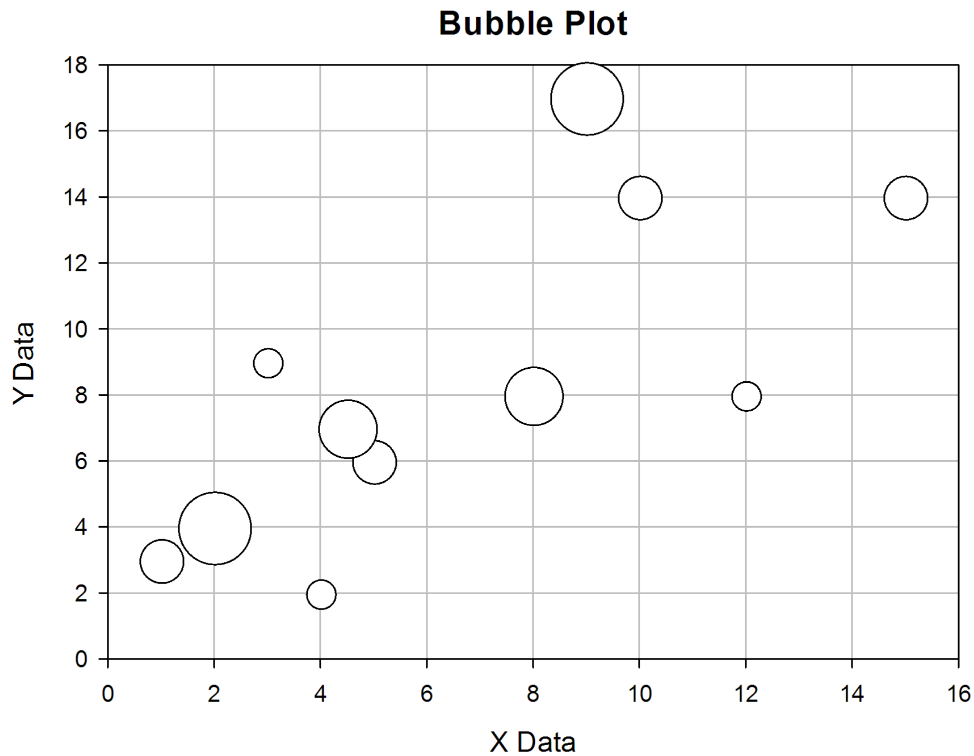
6. Right-click that same **Type** box, and click **Symbol Font**.
   The **Text Properties** dialog box appears.
7. Click the **Font** tab.
8. Select another font from the **Font** drop-down list.

> **Tip:**
> This feature is especially useful if you wish to use Wingdings, Zapf Dingbats, or other iconic or symbolic fonts as a symbol. The **Fill Color** and **Edge Thickness** options do not apply to text and characters.

Using Different Symbol Sizes

By default, all symbols in a plot are the same size. To use symbols of varying sizes, enter symbol size values in a worksheet column, then set symbol size using Graph Properties.

Figure 20. Using Symbol Sizes from a Worksheet Column for Plot Symbols



Symbol sizes are assigned to symbols and curves (or points, if the plot has only one curve) in the same order as the column pairs that form the curves are listed in Graph Wizard.

To use worksheet values for symbol size:

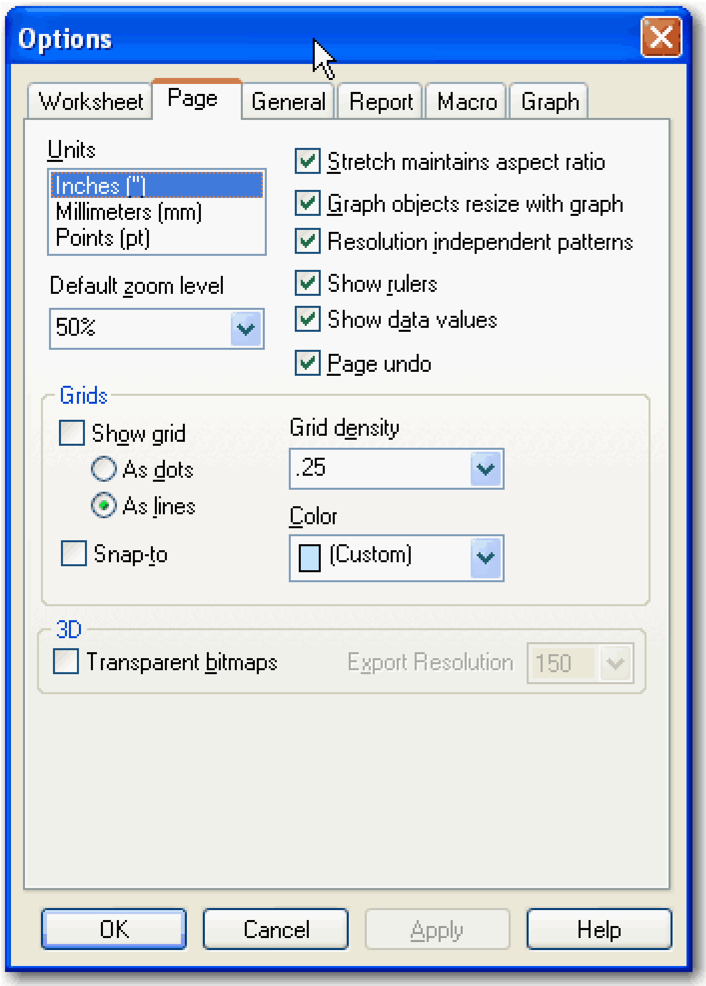
1. Select the first cell of an empty column in the worksheet containing data for the current plot.
2. Type the size values to use in the order you want to use them. Since the symbol sizes correspond to symbol diameters or widths, make sure that the symbol sizes you enter are of a reasonable size, that is, small fractions of inches or only a few millimeters or points.
   If desired, you can also include the measurement unit for the value. For example, for inches type *in*, for millimeters type *mm*, or for points type *pt*.

Figure 21. Example of Worksheet with Symbol Sizes Entered in Column 3

Data 3*

	1-X1	2-Y1	3-Size 1	4	5
1	1.00	3.00	0.30		
2	4.00	2.00	0.20		
3	3.00	9.00	0.20		
4	2.00	4.00	0.50		
5	5.00	6.00	0.30		
6	8.00	8.00	0.40		
7	4.50	7.00	0.40		
8	10.00	14.00	0.30		
9	9.00	17.00	0.50		
10	15.00	14.00	0.30		
11	12.00	8.00	0.20		
12					

If you omit the measurement unit, the numeric values in the symbol size column are assigned the measurement unit specified on the **Page** tab of the **Options** dialog box.



To view, click the **Main Button**\  , click **Options**, and then the **Page** tab.

3. View the graph page and double-click the plot.

   The **Graph Properties** dialog box appears.
4. From the **Properties** list, select: **Plot > Symbols**.
5. If necessary, select the plot that contains the symbols to modify from the **Plot** drop-down list.
6. Select the worksheet column containing the symbol size values from the **Size** drop-down list.

> **Note:**
> When creating a bubble plot, the Graph Wizard automatically prompts you to pick a column to specify bubble size. For more information, see Bubble Plots *(on page 279)*.

Creating and Modifying Embedded SigmaPlot Graphs

When you insert a graph into a document as a SigmaPlot object, different options are available than when viewing graphs inside SigmaPlot.

The following describes the behavior of SigmaPlot features while editing a graph.

> **Tip:**
> You can also open embedded graphs inside SigmaPlot functionality.

Creating Embedded Graphs

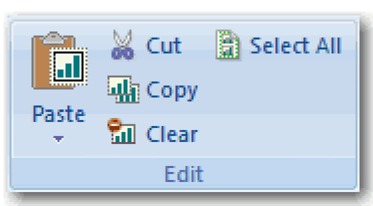
You can create embedded graphs in any number of ways, including:

- Copying and pasting into an application that accepts embedded objects, like Word, Excel or PowerPoint.
- Using the Insert tab from an application that accepts embedded objects.
- Running any of the SigmaPlot integration routines (for example, Excel integration).
- Using the Paste to PowerPoint Slide or Insert Graphs into Word Toolbox macros.

Using Embedded Graph Options

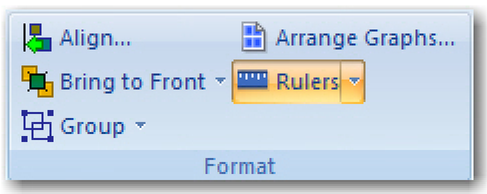
To activate SigmaPlot options for an embedded graph, click the SigmaPlot **Graph** tab, which appears with the following groups:

- **Edit.** Paste, Cut, Copy, Clear, Select All, Graph Properties.



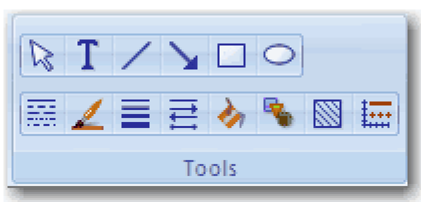
- **Insert.** Insert Graphic File, Word Text, Excel Table, Equation, New Object.

- **Format.** Arrange Graphs, Bring to Front, Group, Align, Send to Back, Ungroup, Rulers

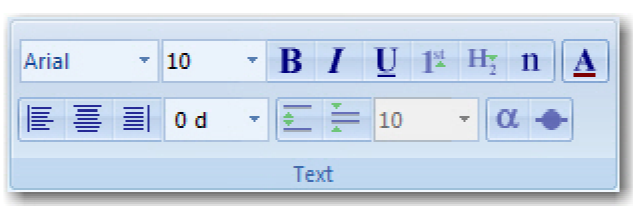


- **Format.** Arrange Graphs, Bring to Front, Group, Align, Send to Back, Ungroup, Show Rulers, Grid Lines, Anti Aliasing

- **Tools.** Select Object, Text, Draw Line, Draw Arrow, Draw Box, Draw Ellipse, Line Type, Line Color, Line Thickness, Fill Color, Symbol Type, Fill Pattern, Axis Scale.



- **Text.** Font, Font Size, Bold, Italic, Underline, Superscript, Subscript, Normal, Color, Align Left, Align Center, Align Right, Rotation, Increase Space, Decrease Space, Line Spacing, Greek Characters, Legend Symbol



Editing Embedded Graphs

You can choose to edit a SigmaPlot graph from inside the current program, or open the embedded graph inside SigmaPlot.

Editing "in-place". To edit a graph in place, double-click it. You can also right-click it and select **Edit the SigmaPlot Graph Object**. To modify the graph at this point, right-click or double-click the graph to access the different settings.

Opening graphs. To open an embedded graph inside SigmaPlot, you can right-click the inactive graph, and click **Open the SigmaPlot Graph Object**. The graph will open as a graph page and worksheet inside SigmaPlot as an Embedded Page.

> **Note:**
> No notebook window or file is associated with this graph.

Viewing Data for an Embedded Graph

If you need to view or edit the data for an embedded graph, you must open that graph inside SigmaPlot.

Resizing Embedded Graphs

The sizing and scaling of the SigmaPlot graph is controlled by the "container" application, that is, the program for the document where the graph has been embedded; however, you can change the size of the page for the embedded graph itself. This is particularly useful if for some reason the graph has been clipped, or you need to rescale and resize the graph or other page objects.

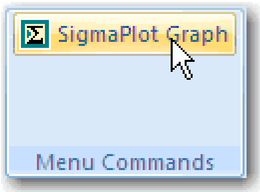
The embedded graph resides on a graph page that has been clipped to just contain the embedded content.

Creating SigmaPlot Graphs Using Microsoft Excel

You can launch the Graph Wizard and subsequently create a SigmaPlot graph using Microsoft Excel. Just as you would using SigmaPlot, you can select data from the worksheet. You can also select ranges of data. If you change your data in Excel, the SigmaPlot graph automatically updates.

To create a graph using Microsoft Excel:

1. View a **Microsoft Excel** worksheet.
2. On the **Add-Ins** tab, in the **Menu Commands** group, click **SigmaPlot Graph**.



3. Create the graph using the **Graph Wizard** as you would normally.

Changing Line Type and Other Line Options

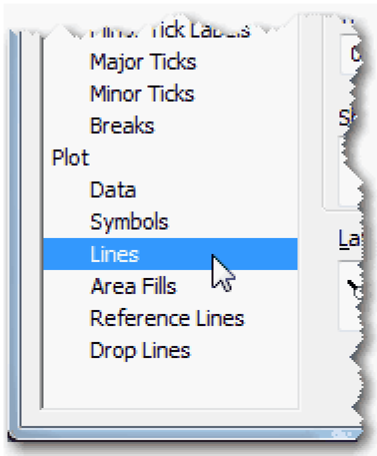
You can change the line type, shape, thickness, and color for all lines in a plot. Because plots can also have multiple curves, you can also increment the line types and colors for any plot with multiple curves.

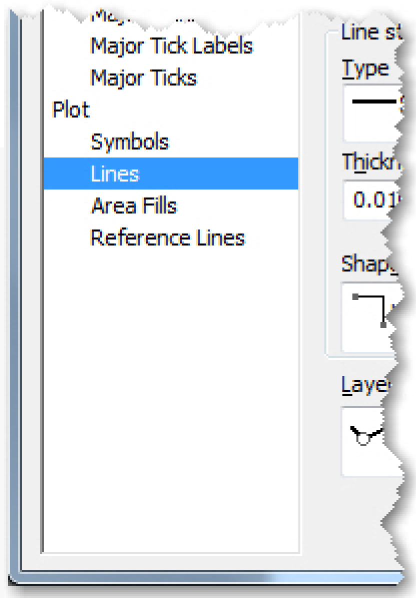
Lines can only be modified in or added to plots that normally use lines, such as scatter plots, line plots, line/scatter plots, polar plots, 3D scatter plots, 3D trajectory plots, and ternary scatter, line, and line/scatter plots.

Changing Plot Line Attributes

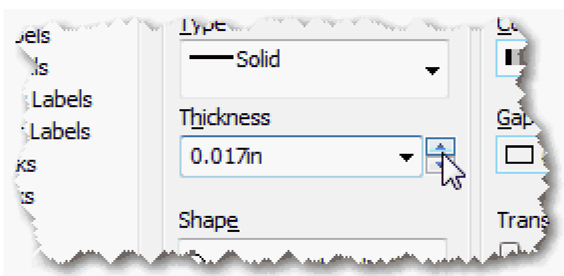
To change the attributes of lines in a selected plot:

1. Double-click the line.
   The **Graph Properties** dialog box appears.
2. In the **Properties** list, select: **Plot > Lines**.

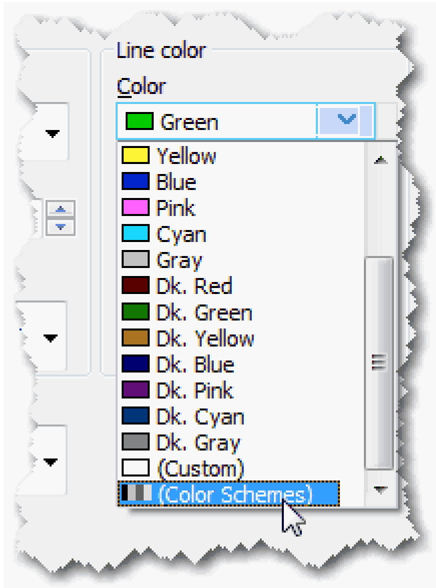




3. **To change the thickness of the line,** type the new value in the **Thickness** box or use the arrow buttons.



4. **To change the color of the lines in the selected plot,** under **Line color**, select a color from the **Color** drop-down list, or choose to increment line color using the one of the incrementing schemes *(on page 127)*.



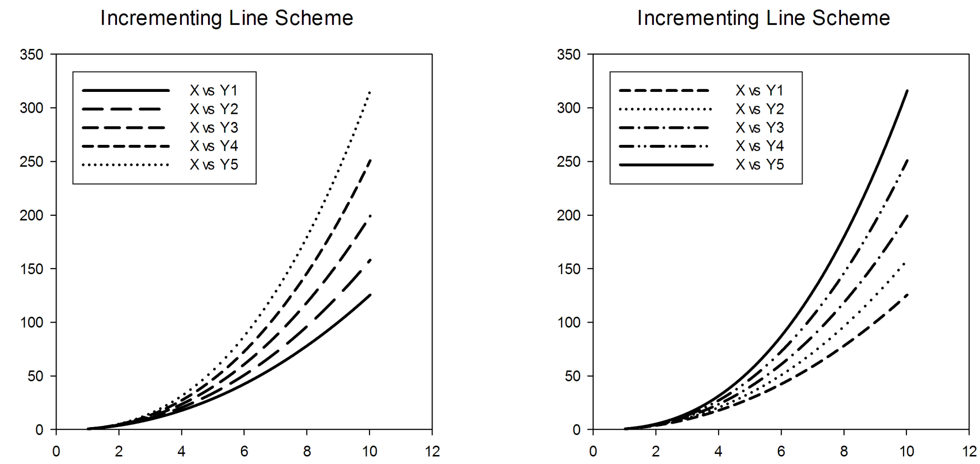
5. **To create transparent lines,** move the **Transparency** slider.
6. **To change or add a gap color,** under **Line color**, select a color from the **Gap Color** drop-down list. This option is only available if you select a line type with actual "gaps" in it, like dotted or dashed, for example.

Automatically Incrementing Lines

Line types and colors appear on the curves of the plot in the same order as the line types and colors in the right-click popup menus of the incrementing option. There are two line type incrementing schemes: Incrementing and Monochrome. There are nine different incrementing color schemes to choose from for line colors.

> **Note:**
> You can also use incrementing color schemes for fills and lines. See incrementing schemes *(on page 127)* for more information.

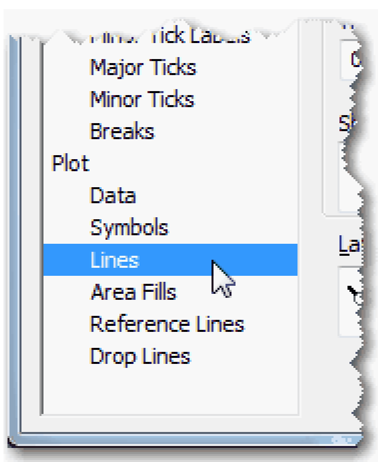
Figure 22. Each of these graphs uses the Incrementing option, but are assigned different starting line types.



To use automatically incrementing line types:

1. Double-click the line.

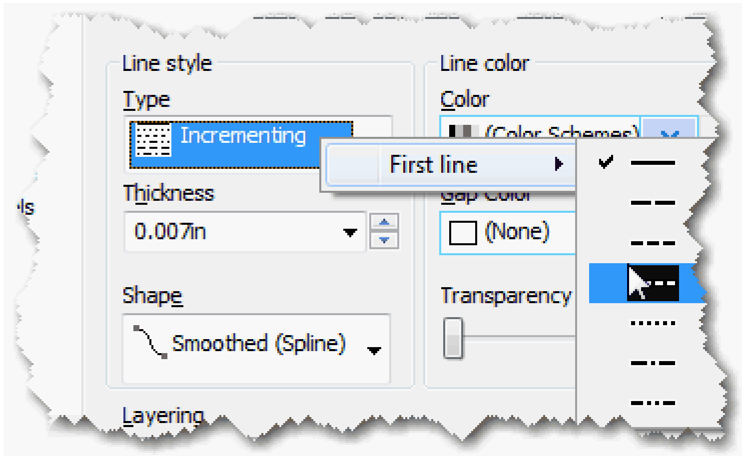
   The **Graph Properties** dialog box appears.
2. In the **Properties** list, select: **Plot > Lines**.



3. From the **Type** and **Color** drop-down lists, choose a line scheme.

> **Note:**
>
> Windows is limited in its ability to supply the true colors for lines by the number of system colors available. For the best representation of true line colors, set your display to either HiColor (16-bit) or TrueColor (24-bit).

4. Right-click the incrementing option selected in the **Type** and **Color** drop-down lists, and select **First Line** or **First Color**.

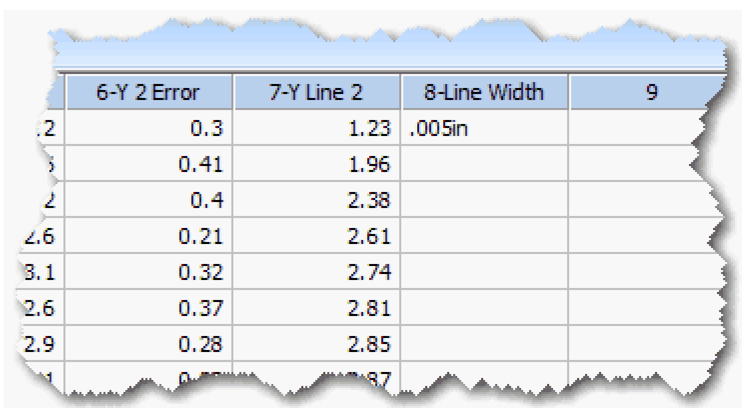


5. Choose the line type or color to start the incrementing sequence.
6. Use the **Line Thickness**, **Shape**, **Line Color**, and **Layering** options to modify the lines, if necessary.

Setting Line Widths from Worksheet Column

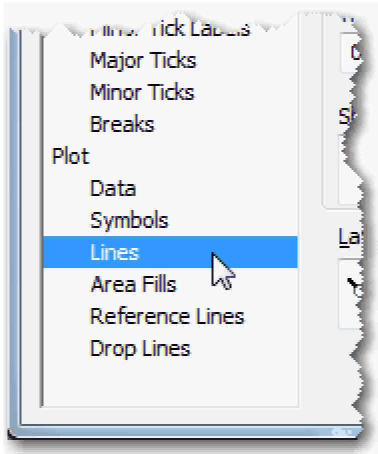
You can control the width of lines on a graph using an empty worksheet column.

1. Enter the line width in an empty worksheet column cell.

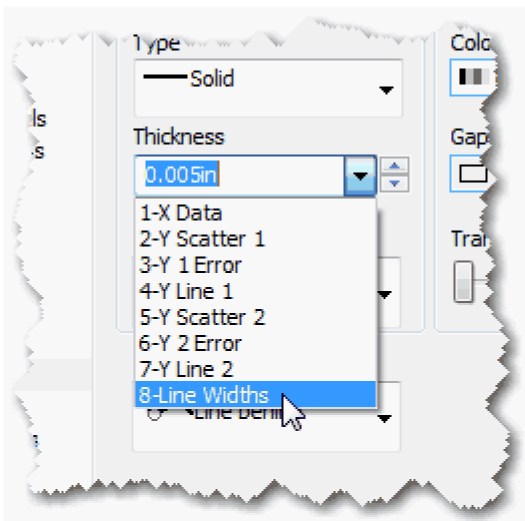


> **Note:**
> Take special care to type “in” for inches after the width.

2. Double-click the line on the graph to open **Graph Properties**. If necessary, navigate to **Plot > Lines** in the **Properties** list.



3. Select the column from the **Thickness** drop-down list.



Changing Patterns and Fill Colors

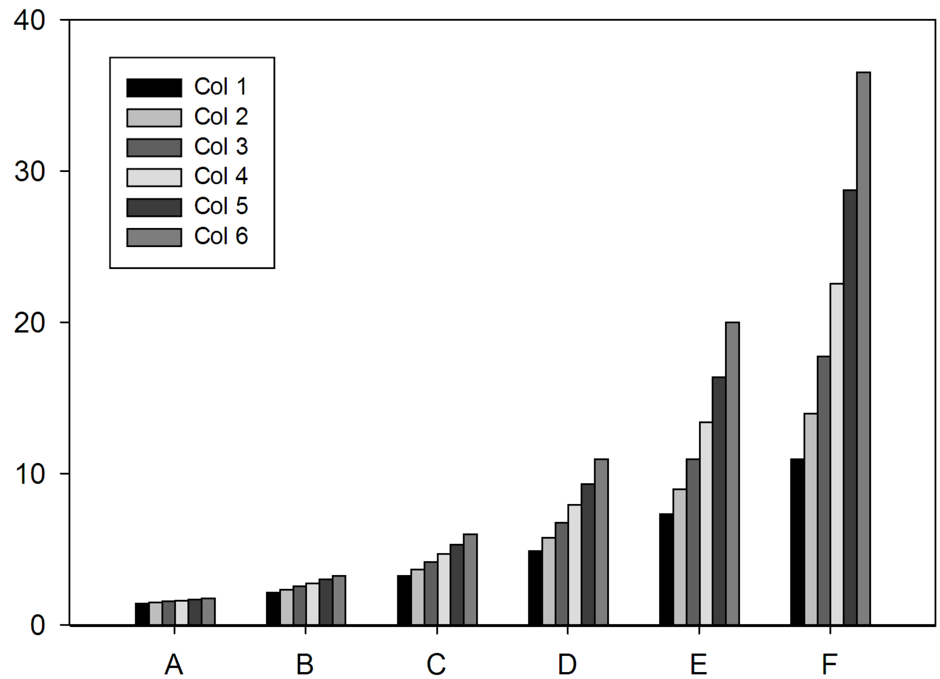
You can modify and increment the background colors, patterns, and pattern colors used for plots.

You can only modify or add fill colors and patterns to plots that normally use fills, for example area plots, bar charts, box plots, pie charts, 3D bar charts, and ternary plots.

Changing Plot Fill Patterns and Colors

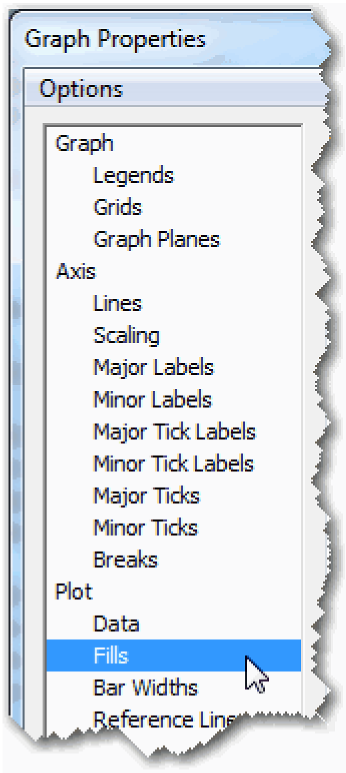
Modern laser printing and color slides have removed much of the need for using hatch marks and other line patterns for bar and pie charts. Instead, use gray shades and colors whenever possible..

Figure 23. Example of a Bar Chart with a Gray Scale Fill Color Scheme

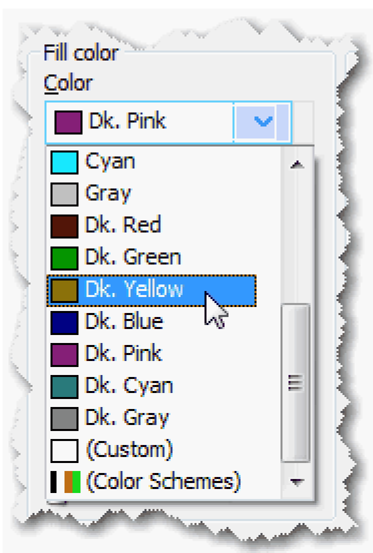


To change fill attributes:

1. Double-click the fill.
2. In the **Properties** list of the **Graph Properties** dialog box, select: **Plot > Fills**.



3. **To change the background fill color,** under **Fill Color**, select a color from the **Color** list, or choose to increment fill colors using the one of the incrementing schemes to change the background fill color.



4. **To turn off background fills,** select **(None)**.
5. **To create a custom color,** select **(Custom)**. For more information, see Using Custom Colors and Incrementing Schemes *(on page 199)*.

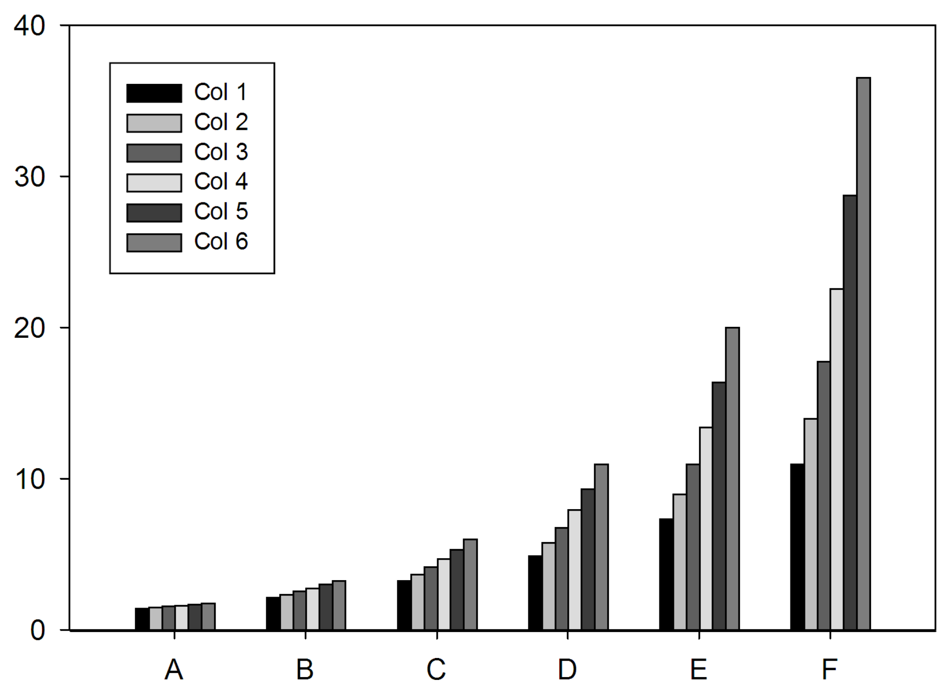
6. **To change the fill pattern for the selected plot,** under **Pattern and Edge**, select a fill pattern from the **Pattern** list, or select to increment fill patterns using one of the fill schemes. To turn off fill patterns, select **(None)**.
7. **To change the thickness of the pattern lines and edges**, move the **Thickness** slider.

Using Custom Symbol, Fill, Line, and Color Increments

When using a series of incremented symbols, fills, lines, or colors you have defined, the increment scheme is assigned to curves or points in the same order the columns plotted for the curves are listed in the Graph Wizard.

> **Note:**
> This topic discusses using the **Insert Graphic Cells** dialog box to create an incremented scheme. To learn how to use Graph Properties for customized color schemes, see incrementing schemes *(on page 127)*

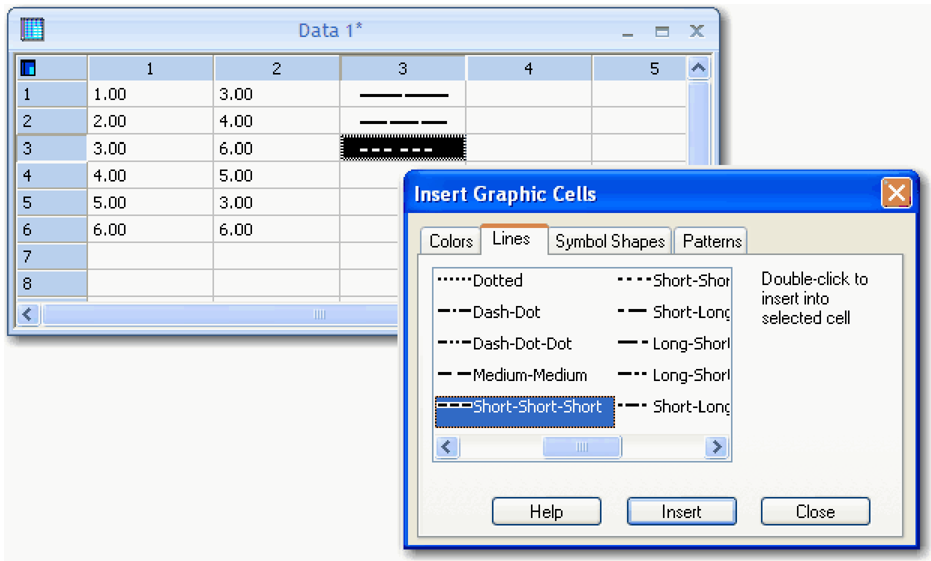
Figure 24. A Bar Chart Using Custom Incremented Fills



To define and apply a series of incremented symbols, fills, lines, or colors:

1. View the worksheet.
2. On the **Worksheet** tab, in the **Cells** group, click **Graphic Cells**.

Figure 25. Using the Insert Graphic Cells Dialog Box to Specify a Custom Line Sequence



3. In the **Insert Graphic Cells** dialog box, click the **Colors**, **Lines**, **Symbols**, or **Patterns** tab.

Tip:
Using symbol types from a column specifies the symbol shape only. If you want to change the symbol fills, create another color column and use it as the symbol fill colors. Typically, white is used for *hollow* symbols, and black for solid symbols.

4. Select the first cell in an empty column in the worksheet.
5. Double-click the color, line, symbol, or fill pattern in the **Insert Graphic Cells** dialog box you want to place in the cell.

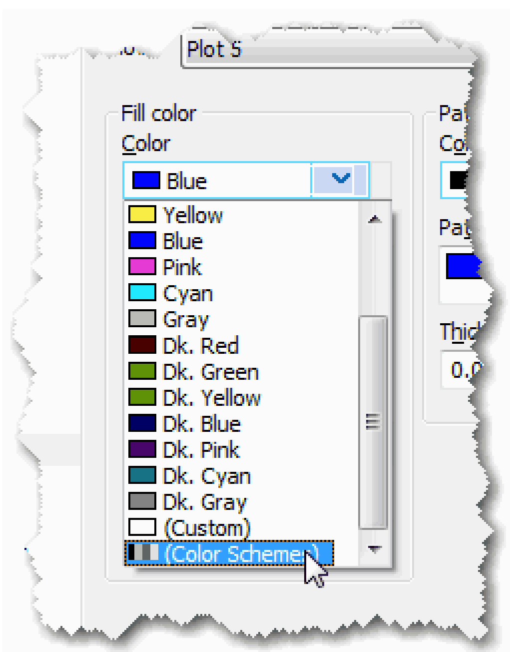
Important:
Do not mix graphic cell types within the same column; for example, place colors in one column, symbols in a different column, fills in yet another column, and lines in a fourth column. You can, however, use multiple columns to define several different increments of the same graphic cell type. For example, you can have several columns containing colors of differently ordered increments. The item appears in the worksheet cell.

6. Continue adding to the column, in the order you want the curves to use the colors, lines, symbols, or patterns. The order of the curves is the order in which they appear in the **Selected Columns** drop-down list in the **Graph Wizard**.
7. Close the **Insert Graphic Cells** dialog box.
8. View the graph page and double-click the graph.
9. In the **Properties** list of the **Graph Properties** dialog box, select:**Fills, Area Fills, Symbols, or Lines**
   What you select depends on what you have defined in the worksheet.
10. Choose the name of the column which contains the appropriate graphic cells from the **Symbols Type**, **Fills Foreground Pattern**, or **Lines Type**, or **Color** drop-down lists.
    If you are applying a large number of colors or other property schemes, you may wish to turn off the automatic legend, which will attempt to display your first 25 different data points. For more information, see Working with Automatic Legends *(on page 187)*.

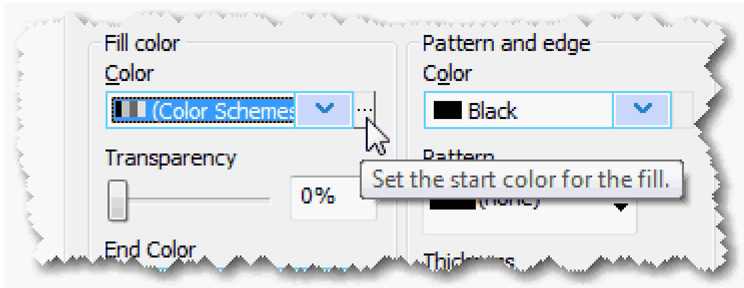
Incrementing Color Schemes

You can select from a number of existing color schemes for any line or fill on plot, whether it be on a bar chart, an area plot, the lines surrounding a bar, and so on. You also have control over which color starts the series.

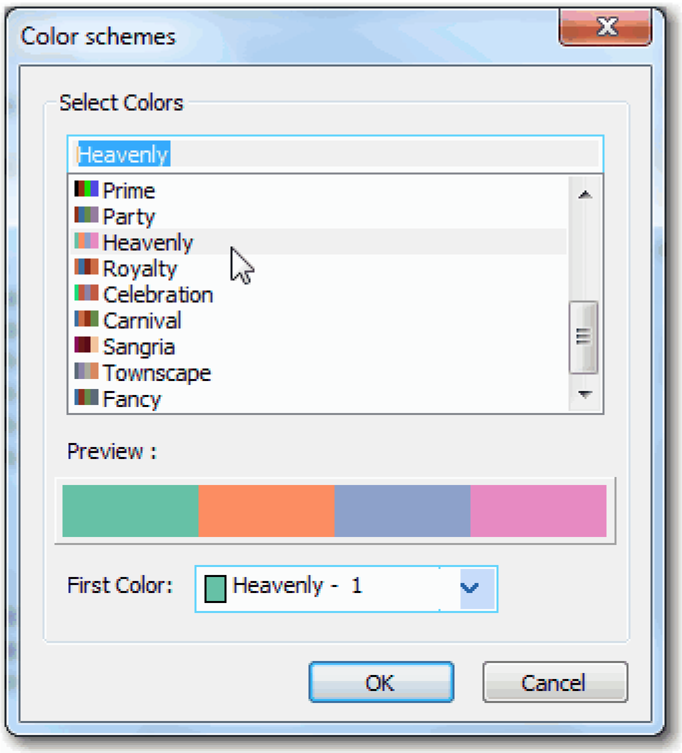
1. Double-click the line or fill to open **Graph Properties**.
2. Select **(Color Schemes)** from any **Color** drop-down list available in **Graph Properties**.



3. Click **...** directly to the right of the **Color** drop-down list to open the **Color Schemes** dialog box.

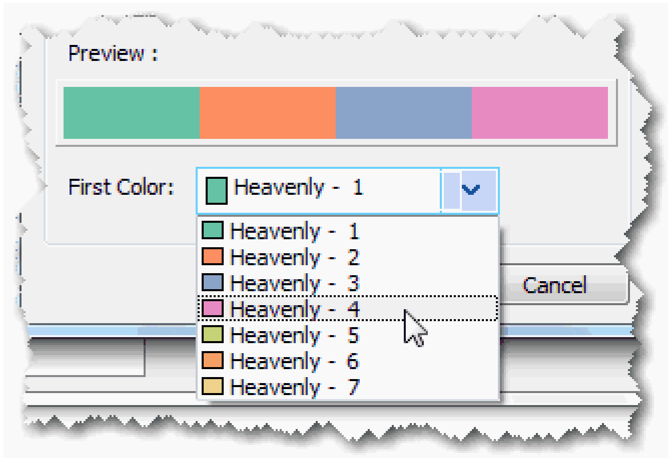


4. Select a scheme from the **Select Colors** list.



A **Preview** of the scheme appears directly below.

5. **To set the first color,** select from the **First Color** drop-down list.



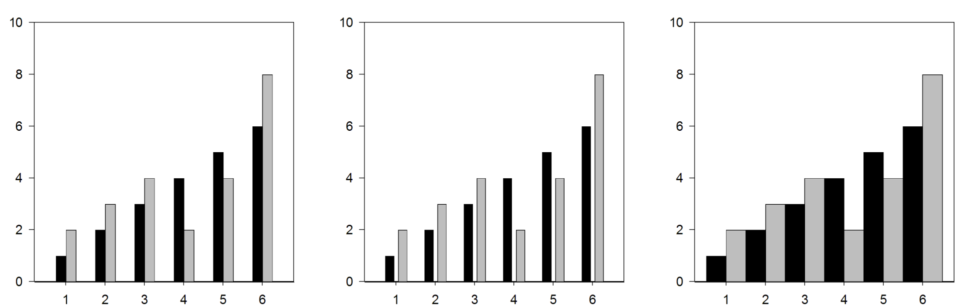
This choice is immediately reflected under **Preview**.

6. Click **OK**.

Changing Bar and Box Widths and Spacing

Control the amount of space between bars and boxes, and between grouped 2D and 3D bars by adjusting the percent of the maximum possible widths of both the individual bars and the bar groups.

Figure 26. From left to right: bar charts with a group spacing of 50% and relative thickness of 100%, group spacing and relative thickness both set to 66%, and both settings set to 100%.



To control bar and box width and spacing for bar charts and box plots:

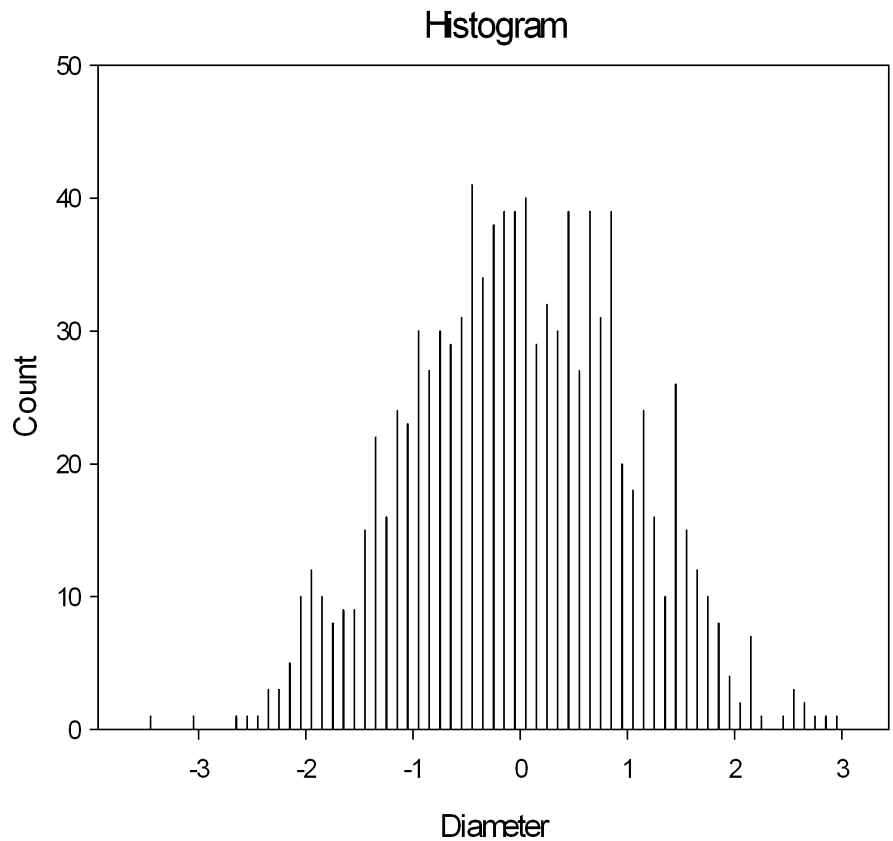
1. Double-click the plot to modify.
2. In the **Properties** list of the **Graph Properties** dialog box, select: **Plot > Widths**
3. **To change the width and spacing between bars for all bar charts and box plots,** move the **Bar thickness** slider. The wider the bars or boxes, the less space between them. The narrower the bars or boxes, the more space between them.

4. **To change the width and spacing between groups of 2D and 3D bars,** move the **Group spacing** slider. This option is only available for grouped and 3D bar charts. SigmaPlot sets grouped bar widths and spacing to as wide or as narrow and as far or as close as possible given the corresponding spacing or width setting.
5. **To set a constant width for all bars or boxes,** from the **Bar Width style** drop-down list, select **Uniform**. This is the default setting. If the bars are set to **Uniform**, the **Bar thickness** setting has the same effect on all bars. For more information, see Uniform versus Variable Bar Widths *(on page 132)*.
6. **To set potentially uneven widths for bars and boxes,** select **Variable** from the **Width** drop-down list. If the constant column values are uneven, the bars will vary in width according to the corresponding axis values. If the bars are set to **Variable**, change bar widths according to the percent of their total widths so that wide bars are more affected than thin bars.

> **Note:**
> Bars created with a single plot will not overlap; however, you can create bars using separate plots and overlap them. For more information, see Spacing Bars from Different Plots *(on page 263)*.

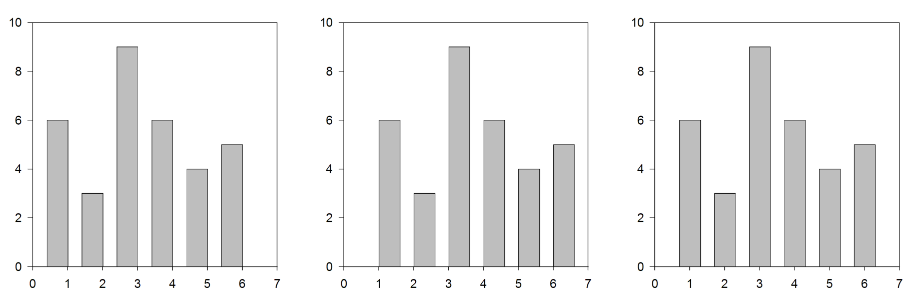
7. **To create a needle plot,** move the **Bar thickness** slider to set bar widths to the narrowest possible widths.

Figure 27. To make a histogram needle plot, create a bar chart and set the Bar Thickness to Needle.



8. **To change bar alignment,** select either **Center**, **Left**, or **Right** from the **Bar Alignment** drop-down list.
   By default, bar chart bars are centered around the data point. Use **Bar Alignment** to alternately draw the bars right or left aligned with the data points.

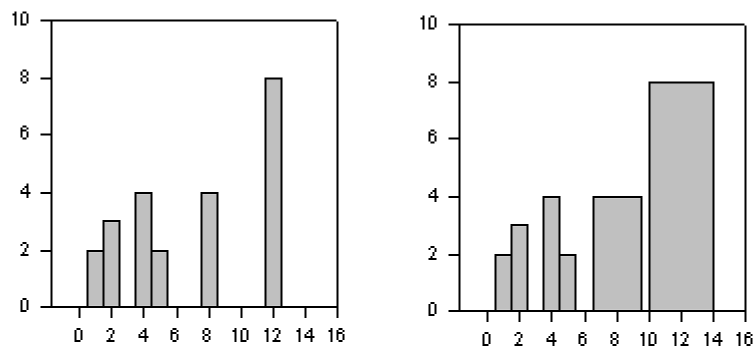
Figure 28. From Left To Right: Bar Charts with Alignments to the Left of the X Points, to the Right of the X Points, and Centered over the X Data Points



Uniform versus Variable Bar Widths

Uniform bar widths set all individual bars to the same width, using the width of the narrowest bar. If the values which the bars are plotted along are unevenly incremented, the bar widths still remain constant.

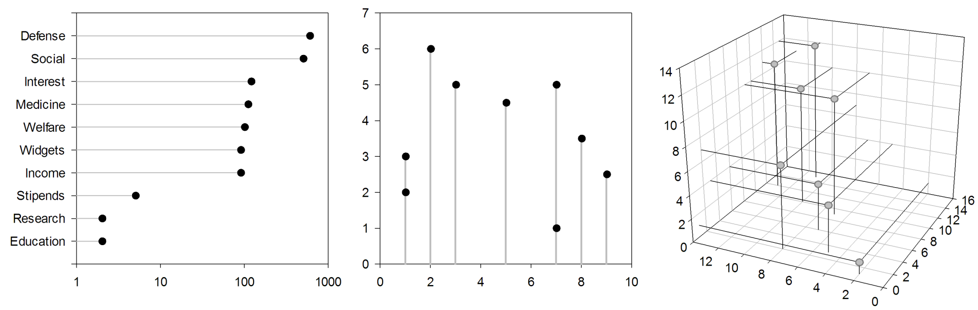
Variable bar widths set the widths to be as wide as possible, as determined by the Bar Thickness and Group Spacing settings. If the values which the bars are plotted along are evenly incremented, this option has no effect. However, if the values which the bars are plotted along are unevenly incremented, the bar widths will vary according to their corresponding values.



Adding and Modifying Drop Lines

Use drop lines to produce dot plots on 3D graphs which connect data points to their axis values. You can add drop lines from plotted data points to either or both axes in a 2D scatter, or line, or line/ scatter plot, or to any or all back planes in a 3D scatter or trajectory plot. Drop lines are drawn for every curve in a plot.

Figure 29. The graphs on the left are examples of 2D plots with drop lines to the Y and X axes. The graph on the right is an example of a 3D graph with drop lines to all axes.

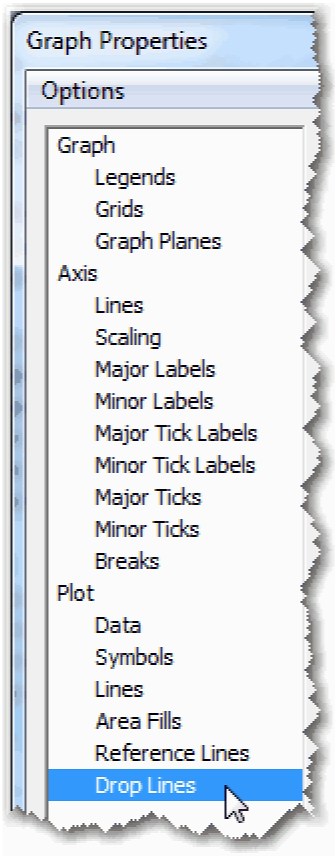


Drop lines always fall toward the minimum of a range; for example, if a Y axis range were reversed, a drop line to the X axis would fall to the top of the graph rather than the bottom.

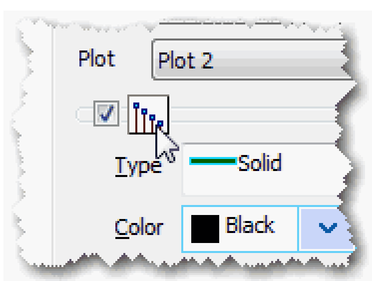
Use the Drop Lines settings in the Graph Properties to create new drop lines, and to modify existing drop line type, thickness, and color.

To add or modify drop lines for a selected plot:

1. Double-click the plot to modify.
2. In the **Properties** list of the **Graph Properties** dialog box, select: **Plot > Drop Lines**.



3. Select the **X**, **Y** (or **Z**) drop-line. Drop lines are added to any and all planes or axes that are selected.

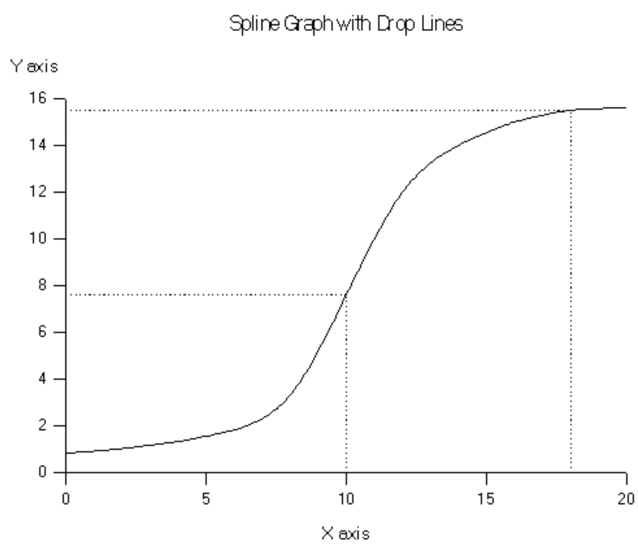


4. **To adjust line thickness,** move the **Thickness** slider, type the new value in the **Thickness** box.

5. **To set drop line color,** select a color from the **Color** drop-down lists. Select any of the listed colors, or select **(Custom)** to select or define a custom color. For more information, see Using Custom Colors and Incrementing Schemes *(on page 199)*.

Drop Lines for a Single Point

You can use drop lines to indicate the position of a single point. To show a single drop line, create a second plot which graphs only the desired data point, then add drop lines to the single-point plot. If you do not want the symbol to show for the point, set the symbol type to (None).



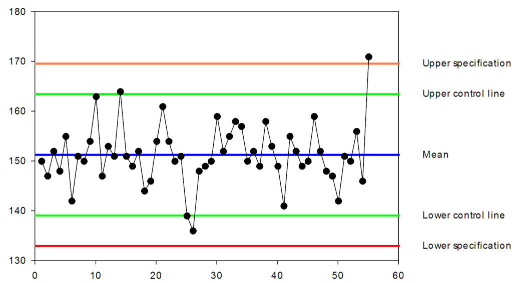
Adding Reference Lines

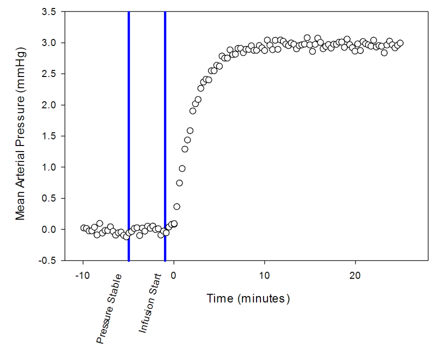
You can add horizontal or vertical lines at specific locations using Graph Properties. Use reference lines to draw lines at specific values, to set quality control limits, and specify other reference values.

> **Note:**
> Bar and stacked bar charts automatically place a reference line at the zero value.

You can add up to five reference lines. All lines can be drawn only horizontally or vertically as a set. The Reference settings display the current calculation, line type, label, and color for each line.

One set of five reference lines, either horizontal or vertical, can be drawn for each plot. If you need more than five lines or need both horizontal and vertical lines, you must create an additional plot. For more information, see Adding Plots *(on page 78)*.

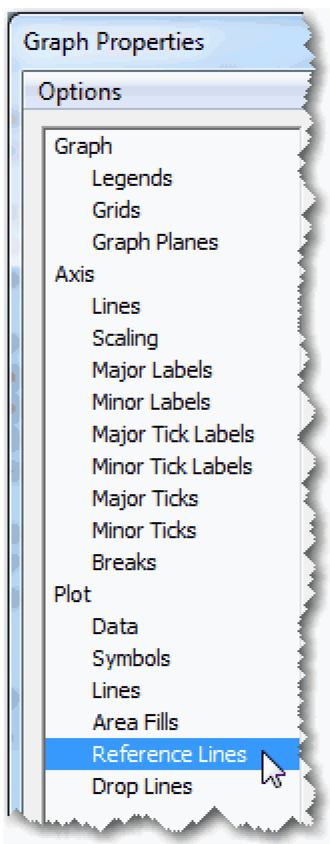




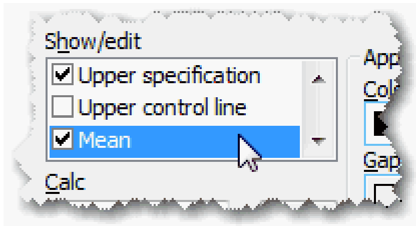
Drawing Reference Lines

To draw reference lines:

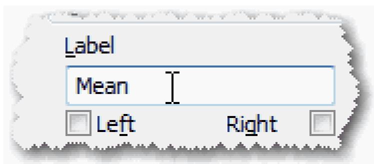
1. Double-click the plot to open the **Graph Properties** dialog box.
2. In the Properties list, select: **Plot > Reference Lines**.



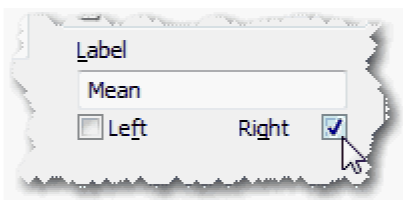
3. Select a reference line from the **Show/edit** list. You can add up to five lines for each plot. The default names and calculations are the names commonly used when employing reference lines for quality control charts.



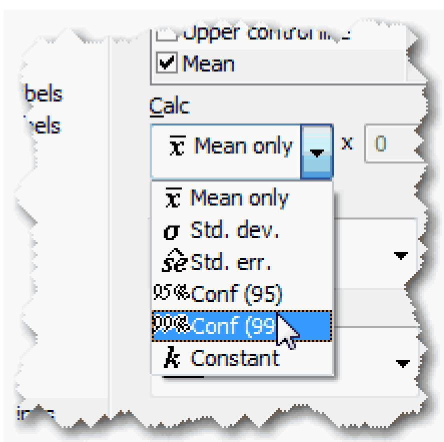
4. **To change the reference line name,** select the line from the list, then edit the Label box for that line.



5. **To display the label next to the reference line,** select **Left** or **Right** for horizontal reference lines, or **Top** or **Bottom** for vertical reference lines.



6. **To change the value or statistic used for the line,** select an option from the **Calc** drop-down list.

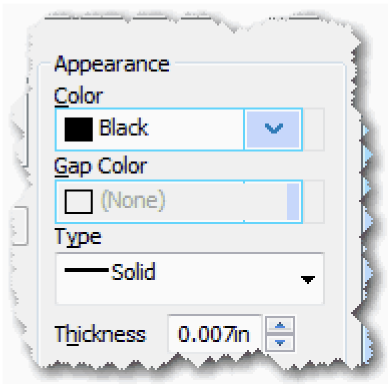


If you are not using a mean as the calculation, type a value to multiply the statistic by, or a value to use as a constant, in the box next to the **Calc** drop-down list. The calculation options apply only to the reference line highlighted in the **Graph Properties** dialog box list of reference lines.

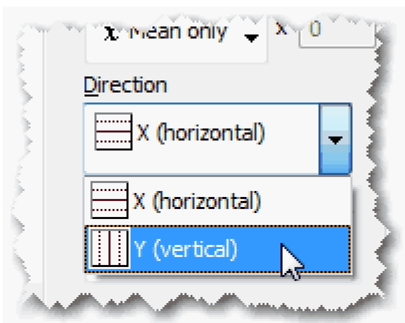
To set the reference line value to a specific value, select **Constant Calc**, and enter the value to the right.

Automatically calculated statistics are derived from the plot data. All data points graphed, including multiple columns of data, are used for reference line calculations.

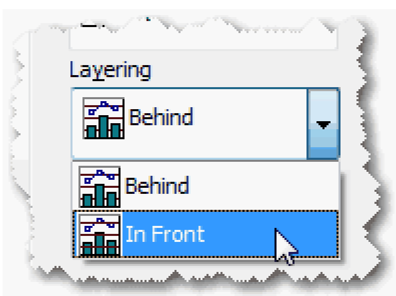
7. Use the **Appearance** options to set a line type, thickness, and color for the highlighted reference line. Each reference line can have separate line attributes.



8. Use the **Direction** drop-down list to draw reference lines horizontally or vertically.



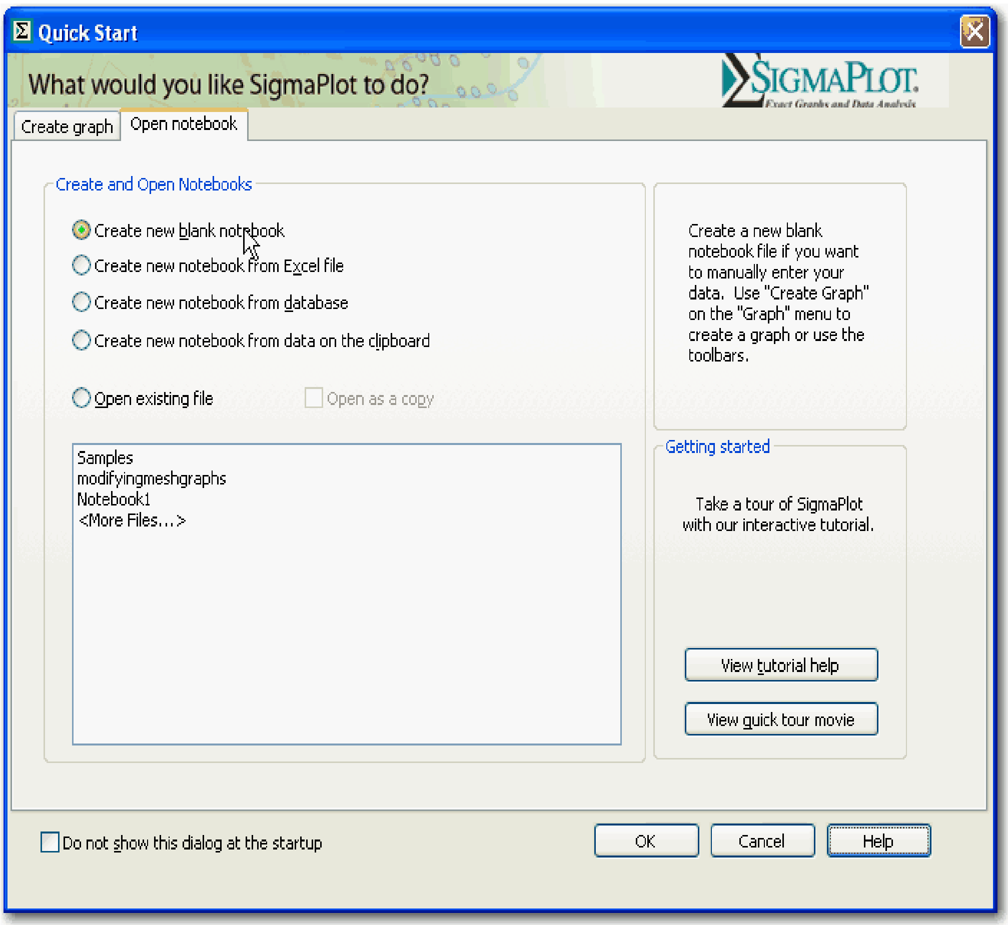
9. Use the **Layering** drop-down list to draw reference lines either **Behind** or **In Front** of the selected plot.



Chapter 3. Notebook Manager Basics

Notebooks are where you store all your worksheets, graphs, and reports, and the Notebook Manager is were you keep all of this information organized.

When you first start SigmaPlot, the **Quick Start** dialog box appears with the **Open notebook** tab in view, with a variety of options to start creating graphs. The simplest way is to select the first option, **Create new blank notebook**, and then click **OK**.



The **Quick Start** dialog box closes, and you see the SigmaPlot desktop, with an empty worksheet in view.

Like all the windows open on the SigmaPlot desktop, the you can either dock **Notebook Manager** window or have it be a floating window. *Notebook files* contain all of your data and graphs, and are organized within the Notebook Manager. It is in the **Notebook Manager** that you can open and work with many notebook files at once.

The first time you see the **Notebook Manager**, it appears with one open notebook file, which contains one section. That section contains one empty worksheet. Contents of the **Notebook Manager** appear as a tree structure, similar to Windows Explorer.

Each open notebook appears as the top level, with one or more sections at the second level, and one or more items at the third level. Within each section you can create one worksheet and an unlimited number of graph pages, reports, equations, and macros. The most recently opened notebook file appears at the top of the **Notebook Manager**.

Tip:
To show or hide the Notebook Manager, select **Home > Navigate > Notebook Manager**

Modified Notebook Names

An asterisk next to an item in the **Notebook Manager** indicates that the item has been modified since the last time you saved the notebook.

Notebook Item Names

The default first notebook is named **Notebook1**. It contains one notebook section, Section 1, and one worksheet, Data 1. When you save your notebook file, the name of the file appears at the top of the **Notebook Manager** window. Notebook files use a (.jnb) extension. The default names given to notebook sections and items are, Section (number), Data (number) or Excel (number) and Report (number). Regression equations are named when they are created. New items are numbered sequentially.

Protecting Notebooks

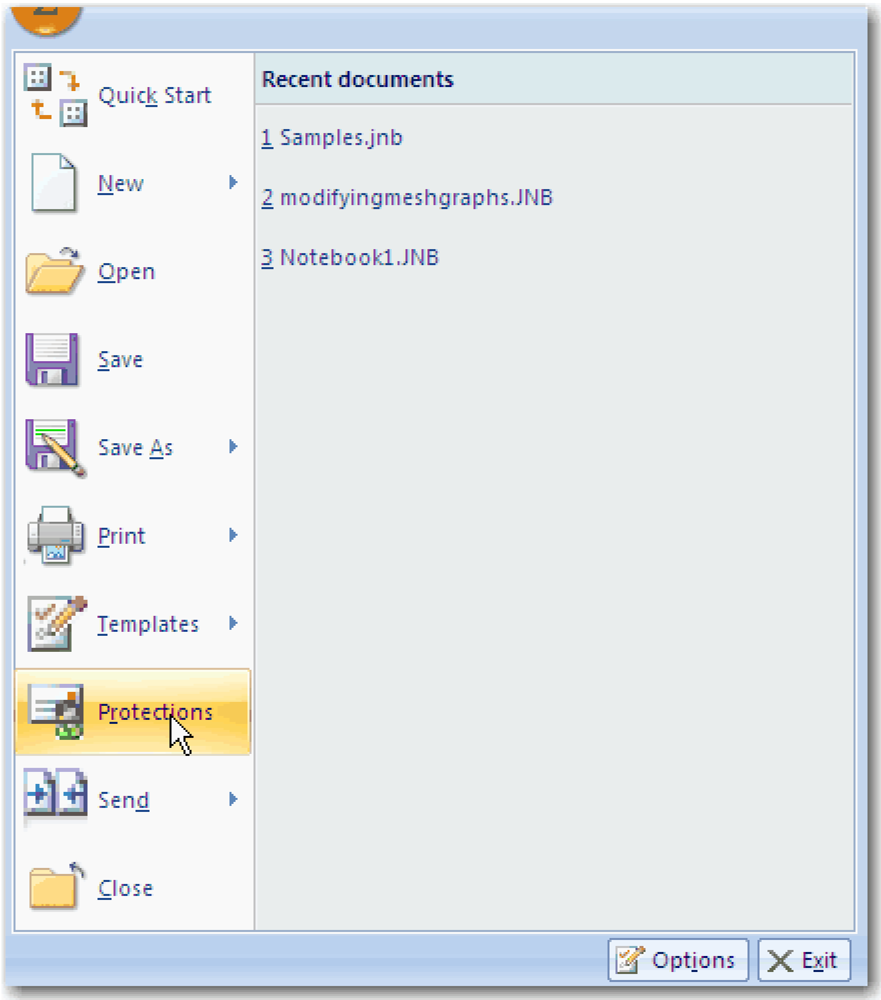
To ensure security of notebook contents, you can lock notebooks using a password. This is particularly useful if two or more users are using the same version of SigmaPlot. You can also use a password to send confidential data to other SigmaPlot users.

Setting a Password

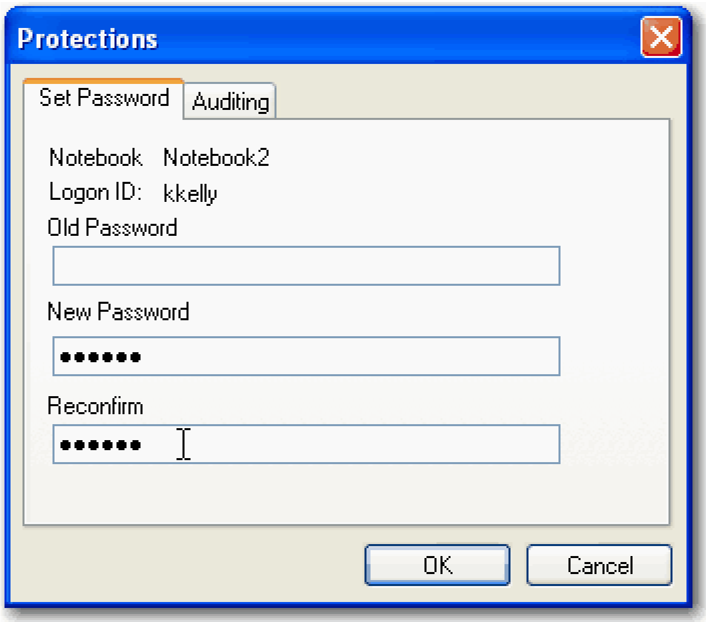
To set a password:

1. Select the notebook in the **Notebook Manager**.
2. Click the **Main Button** .

   The **Password** dialog box appears.
3. Type a new password in the **New Password** box.Click **Protections**.



4. Type it again in the **Reconfirm** field.In the **Set Password** tab on the **Protections** dialog box, type a password in the **New Password** box.



5. Click **OK**. In the **Reconfirm** box, type the password again.

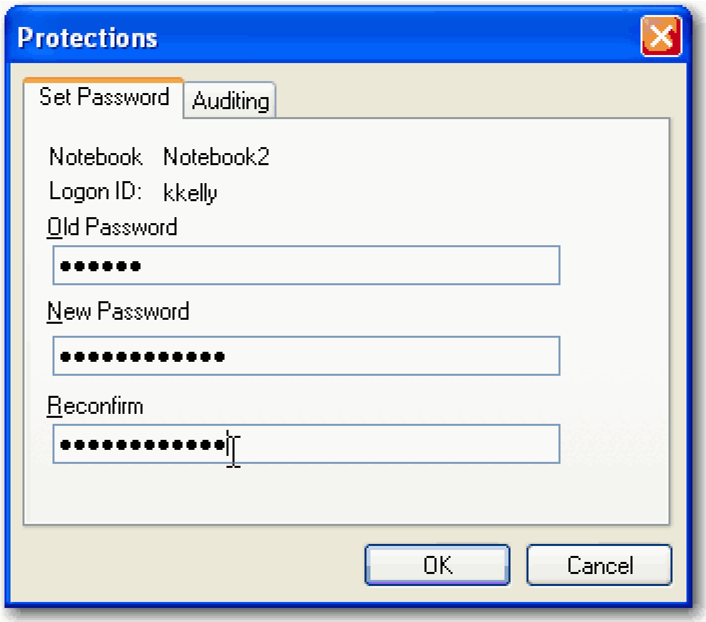
> **Tip:**
> Click the Eye logo to hide or show the password while typing.

6. Click **OK**.

Changing or Removing a Password

To change or remove a password:

1. Select the notebook in the **Notebook Manager**.
2. Click the **Main Button** , and then click **Protections**.
   The **Password** dialog box appears.
3. In the **Set Password** tab on the **Protections** dialog box, type the old password in the **Old Password** box.



4. In the **New Password** box, type a new password.
5. Click **OK**.

Tip:
Click the Eye logo to hide or show the password while typing.

Creating a Notebook Audit List

Use SigmaPlot Auditing to create a record showing who has modified and saved a Notebook file and what operations he or she has performed during a given period of time.

To create an audit list:

1. Click the **Main Button**.
2. Click **Protections**.
3. Click the **Auditing** tab on the **Protections** dialog box.
4. **To create an audit trail,** select **Enable Audit List**.
5. **To prevent other users from disabling the audit list,** enter and reconfirm a password in the **Auditing Password (optional)** and **Reconfirm** fields.
   Creating an Auditing password is optional. Passwords can be any combination of letters, symbols or numbers, up to 250 characters in length. It is strongly advised that if you create a password, write it down as lost passwords can not be retrieved.

6. **To view the audit list,** click **View Audit List**.
7. Click **OK** to save passwords and settings and to close the **Protections** dialog box.

Working with Sections in the Notebook Manager

Notebook sections are placeholders in the notebook. They contain notebook items, but no data; however, you can name, open, and close notebook sections.

You can create as many new sections as you want in a notebook. You may also create reports within each section to document the items in each section.

To expand or collapse a section, double-click the section icon or click the .

Creating New Items in the Notebook Manager

Using the right-click shortcut menu, you can create new sections and items in the Notebook Manager, such as:

- Worksheets
- Excel Worksheets
- Graph pages
- Reports
- Equations
- Sections
- Transforms
- Macros

To create a new section or item:

1. Right-click anywhere in the **Notebook Manager** in which you want the new section or item to appear.
2. On the shortcut menu click **New**, and then the item to create.
   The new section or item appears in the **Notebook Manager**.

Copying and Pasting to Create New Sections

Another way to create a new notebook section is to copy and paste a section in the notebook window. Whenever you copy and paste a section, its contents appear at the bottom of the notebook window.

SigmaPlot names and numbers the section automatically. For example, if you copy notebook Section 3, the new section is named Copy of Section 3.

Copied sections create copies of all items within that section as well.

Renaming Notebook Files and Items

You can change summary information for all notebook files and items.

To change summary information:

1. If the summary information is hidden on the **Notebook Manager**, click **Summary Info**.
2. Select the notebook item and edit as appropriate.

In-place Editing Section and Item Names

You can change the name of a notebook section or item in the notebook itself without opening the Summary Information dialog box.

To in-place edit:

1. In the **Notebook Manager**, right-click the section or item you want to rename.
2. Select **Rename**.
3. Type the new name.
4. Press **Enter**. The new section or item name appears.

> **Tip:**
> To change the name of the notebook, right-click and select **Save As**.

Copying a Page to a Section with No Worksheet

If you copy a graph page into an empty section or a section that has no worksheet, you create an independent page. The independent page retains all its plotted data without the worksheet. You can store the pages from several different sections that have different data together this way. However, if you ever create or paste a worksheet into a section, all independent pages will revert to plotting the data from the new worksheet.

Use independent pages as templates, or to draw or store objects. You cannot create graphs for an independent page until it is associated with a worksheet (and no longer independent).

Dragging and Dropping Items in the Notebook Manager

You can move items within sections and sections within notebooks. Worksheets, however, always stay at the top of their sections.

To drag and drop notebook items and sections:

1. Select the item.
2. Hold the mouse button and drag the item to its new location.

Opening Files in the Notebook Manager

You can open SigmaPlot files and other types of files as SigmaPlot notebooks.

To open a notebook file that is stored on a disk:

1. Click the .
2. Click **Open**.
3. In the **Open** dialog box, choose the appropriate drive and directory of the notebook file to open.
4. Double-click the desired notebook file.
5. **If you want to open another type of file**, choose the type of file from the **Files of type** list.
6. Click **Open**. The opened notebook appears in the **Notebook Manager**.

Opening Worksheets, Reports, and Pages

You can open a worksheet, report, or page by double-clicking its icon in the **Notebook Manager**. You can also right-click the item, and on the shortcut menu, click **Open**. Open worksheets, pages and report appear in their own window, and in the notebook as a colored icons.

Double-clicking an item that is already open brings the item's window to the front.

Opening Multiple Items

You can open as many items as your system's memory allows. You can open multiple items from multiple notebooks. The selected item appears highlighted in the **Notebook Manager**.

Copying and Pasting Items in the Notebook Manager

You can copy and paste items from one open notebook file to another in the Notebook Manager; however, you cannot copy a worksheet into a notebook section that already contains a worksheet.

Copying and pasting pages and worksheets between sections results in using graph pages as templates. For more information, see Using Templates *(on page 155)*.

To copy and paste a notebook item:

1. Right-click the item in the **Notebook Manager** that you want to copy, and on the shortcut menu, click **Copy**.
2. Right-click the section where you want to paste the item, and on the shortcut menu, click **Paste**. The selected item is pasted to the current notebook and section.

Deleting Items in the Notebook Manager

To delete an item from the **Notebook Manager**:

Select the item and press **Delete**. The item is deleted.

Note:
Items removed from a notebook file using the **Delete** button are removed permanently.

Chapter 4. Graph Page Basics

Use Graph Pages to display and modify graphs that plot data from your worksheets.

You can create as many graph pages as you wish per worksheet. New graph pages are associated with the current worksheet, and are placed in the current notebook *(on page 139)* section.

About Graph Pages

Graph pages are true graphical representations of a printed page that contain graphs, text, and other drawn and pasted objects. You can select objects on graph pages and modify them using **Graph Properties** and with options available on the **Graph Page** tab. You can manipulate all objects graphically using your mouse.

A page can contain an unlimited number of graphs and other objects, and you can create an unlimited number of pages for each worksheet.

Graph pages are created in several ways. You can create a graph page as a notebook item, or by using the **Graph Wizard**, the **Graph Style Gallery** or by templates. For more information, see Creating and Modifying Graphs *(on page 52)*.

Setting Page Options

You can control graph page properties on the **Page** tab of the **Options** dialog box. To open the **Options** dialog box:

1. Click the .
2. Click **Options**.
3. Click the **Page** tab.

Exporting Graphs and Pages

You can export SigmaPlot graphs and graph pages to other files formats.

To export a graph or graph page:

1. Select and view the graph page. If you want to export specific graph(s), select the graphs you want to export to a file.
2. On the **Home** tab, in the **Export** group, click the **Graph** drop-down list.
3. Click **Export**.
4. In the **Export File** dialog box, enter the file name, directory and drive for the export file destination.

> **Restriction:**
> If you select WMF or EPS file formats, be aware that SigmaPlot does not support anti-aliasing, gradient fills, and partial color transparency.

5. Click **Save**. If you chose one of the graphic file formats, a secondary dialog box appears, asking you to enter some graphic format information.
6. Enter the desired **DPI** and **Color Resolutions**; for EPS files, these setting only affect the resolutions of the TIFF header, not the actual PostScript resolution. For metafiles, this setting affects only 3D graphs.
   The higher the DPI and Color resolutions, the better quality the image, but also the larger the file. Limit the DPI and Color resolutions to the capability of the intended output device. For example, if you are going to create 600 dpi slide output, set the DPI resolution no larger than 600.
7. If you want to export only the selected graph(s) or objects, select **Export selected only**.
8. Click **OK** to create the exported file using the specified file name and graphic resolutions, if applicable.

Printing Graph Pages

You can print any graph in a SigmaPlot notebook.

1. To print a graph page:
   a. Select and view the page window.
   b. Click the and then click **Print** to print the page using all the default settings.
2. To set printing options before you print the graph page:
   a. Click and then click **Print**.
   b. In the **Print** dialog box, click **Properties**.

c. Click **OK** when you are satisfied with the printer properties settings.

> **Restriction:**
> The **Properties** dialog box options vary from printer to printer.

d. Click **OK** to print the graph.

Saving Graphs as PDF

To save a graph as a PDF file:

1. On the graph page, select the graph.
2. Click the **Home** tab, and then in the **Export** group, click **Create PDF**.
3. Click the **Home** tab, and then in the **Export** group, click **Create PDF**.
4. In the **File Name** list, type or select a name for the graph.
5. In the **Save as type** list, click **PDF**.
6. Click **Save**.

Working with Page Objects

Using SigmaPlot ribbon commands, Graph Properties, Object Properties, and wizards you can create and modify graphs and other page objects.

Graph Wizard

The *Graph Wizard* guides you through a series of dialog boxes to select the type and style of graph, and to select worksheet data for plotting. After you create the graph, you can open the Graph Wizard to add or modify plots and axes.

Graph Properties

Graph Properties customizes the plots, axes, grids planes, titles and legends of your graph. Use it for more advanced modifications to your graph.

To open the **Graph Properties** dialog box, double-click anywhere on the graph.

Object Properties

Object Properties modifies many graph attributes including drawn objects. Use Object Properties to make simple modifications to the objects and graphs. The **Line** and **Fill** tabs change fill patterns, lines of your plots and objects. The **Size and Position** tab changes position, scaling and size for all selected objects.

To open the **Object Properties** dialog box, double-click the object.

Text Properties

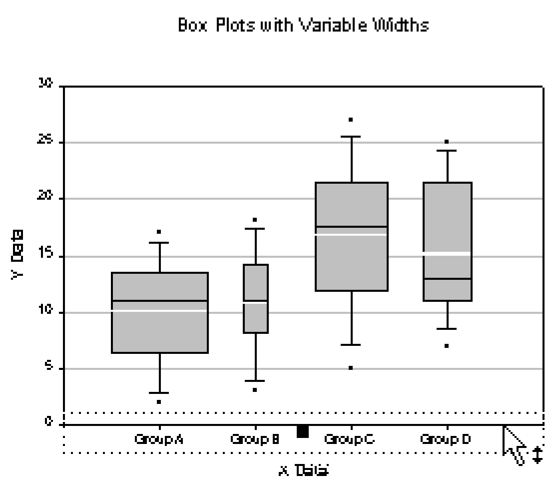
Most Text Properties appear either in the **Text** group on the **Graph Page** tab or you can right-click text on a graph to open the **Text Properties** dialog box.

Selecting Page Objects

When you select text, drawn objects, or individual elements on the graph page, and then double-click, you open the dialog box specific to that element.

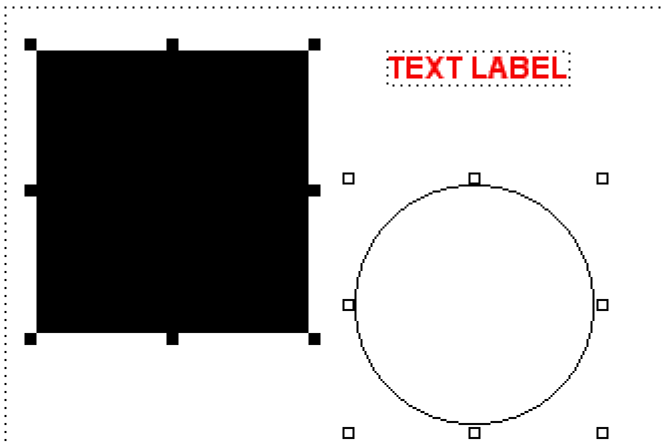
To select a graph element, make sure you are in selection mode by clicking **Select Object** in the **Tools** group on the **Graph Page** tab.

Selected objects are surrounded with square handles; selected axes and text are surrounded by dotted lines.



Selecting Multiple Objects

To select multiple objects, hold down the Shift key while clicking objects, or drag a window completely around the objects you want to select. When you select multiple objects, only the last selected object has solid black handles; the other objects have hollow handles.



You can edit, copy, paste, move, size and scale, delete or hide all selected page objects, including graphs, text, drawn objects, and pasted objects.

Selecting Objects that Overlay One Another

To select objects that overlay one another, press either the Alt-Click or Alt-Arrow keys.

1. To use Alt-Click:

    a. Click the object that you want to select, which may be covered by another object, and then press the Alt key.

    b. While holding down the Alt key, repeatedly click the object until it is selected under the position that you initially clicked.
    As you repeatedly click you will cycle through all objects that overlay one another.

2. To use Alt-Arrow:

a. Click the object that you want to select and then press the Alt key.

b. While holding down the Alt key, repeatedly press one of the arrow keys (up, down, right, or left) to select the object of interest. Use of different arrow keys will cycle through the objects in a different order.

> **Tip:**
> It is important that you click on top of the object that you eventually wish to select. For example, selecting the intersection of the horizontal and vertical grid lines slightly below the symbol will result in a different sequence of selectable objects, that is, vertical grid line, right y-axis, horizontal grid line and plot error bars. It is not possible in this case to select the symbol.

Real Time Mouse-Over Feedback

You can obtain numeric data values from your plots by placing the mouse cursor over the data points. To do this click on the particular plot to select it. Then move the mouse cursor over the data points. When the cursor is over a data point the cursor background color is cyan and you can read the numeric value from the cursor window. When the cursor is not over a data point you can read the position of the cursor using the x and y scales for that plot.

If you would like to disable mouse over feedback:

1. Click the .
2. Click **Options**.
3. Click the **Page** tab.
4. Clear **Show data values**.

Adding Another Graph to a Page

You can add additional graphs to the current graph page by:

- Creating a new graph onto the current page.
- Copying a graph to the same page.
- Copying and pasting a graph from another page.

Creating a New Graph on the Current Page

If you want to add a graph to a page by creating a new graph:

1. Add the data for the new graph in the worksheet associated with the current graph page.
2. On the **Create Graph** tab, click **Graph Wizard** in the **Wizard** group.
3. Follow the steps in the **Graph Wizard**.
4. After clicking **Finish** to create the graph, you'll need to align the graphs on the graph page, which you can do manually, or on the **Graph Page** tab, in the **Format** group, click **Arrange Graphs**. For more information, see Arranging Graphs *(on page 179)*.

Copying a Graph on the Same Page

One of the quickest and the easiest ways to add a second graph is to copy the one you have already created, arrange the graphs so they're both visible on the page, and then modify it. For more information, see Arranging Graphs *(on page 179)*.

Copying and Pasting a Graph from One Page to Another

You can copy a graph from a graph page within the current notebook section, or from a different notebook section.

To copy a graph from one page to another:

1. Select the graph you want to copy.
2. Press **Ctrl+C**.
3. Make the destination page the current page.
4. Press **Ctrl+V** to paste the graph.
   The graph appears on the current page, and the graph data appears in the worksheet associated with the current page. Another method is dragging and dropping.

Zooming In and Out

Right-click the graph page (not the graph!), and select **Zoom** or **Zoom window**. You can view the page at several different levels of magnification, magnify the page centering on a specified page location, or choose a completely unobstructed view of the page.

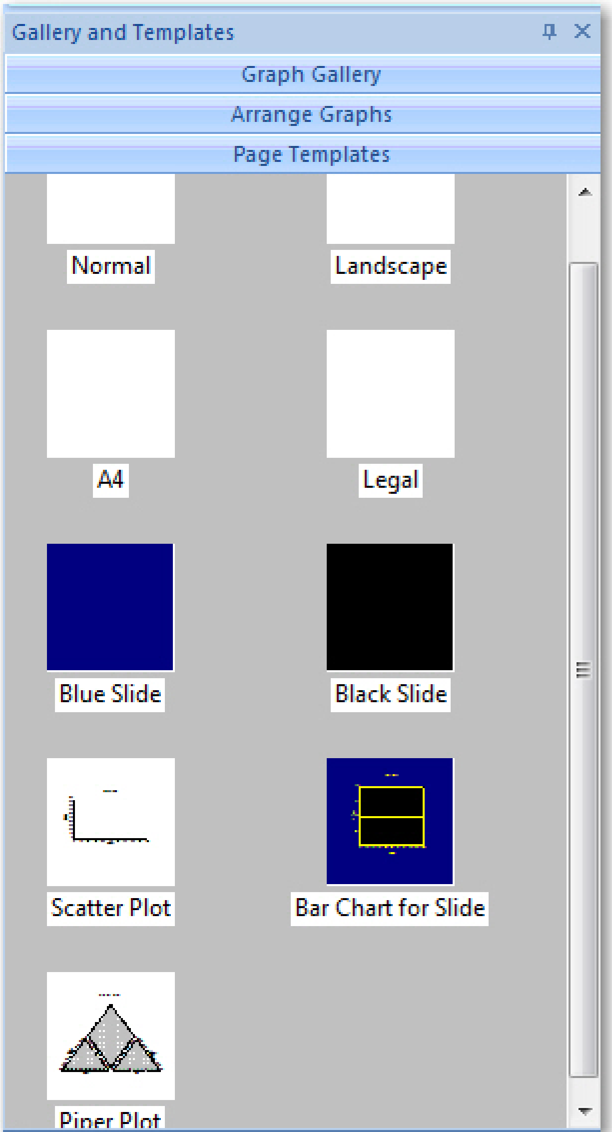
Using Templates

The SigmaPlot template interface can simplify graph and graph page creation and modification.

You can use templates to create pages and graphs with preset properties. For example, if you need to create a set of slides, you can open pages that are already set to attributes for slides.

Attention:
Never use templates to add a graph to a page.

There are two kinds of templates: *template pages* and *template graphs*. You can find examples of these under **Galleries and Templates** on the left-hand side of the SigmaPlot desktop. Click **Page Templates**.



In this group, you'll notice some of the template thumbnails are blank and some have graphs in them. The ones without graphs are called template pages. The ones with graphs are called template graphs.

Template pages are ordinary graph pages. Any graph page can act as a template page. All attributes from the page - size, color, margins, and orientation - are retained. Any graphs and other objects on the page are also duplicated.

Template graphs automatically plot the worksheet column data that was selected when the graph was created.

Now, you might have right-clicked one of these templates on your own, and then clicked **Apply**, and noticed you lost your graph. So don't do that. What you actually need to do is much more complicated, but in the long run, it will make your life easier. These next sections outline these complicated steps.

> **Tip:**
> Graphs created by templates can be modified like any other graph.

Applying Templates

There are three methods to apply a template to a page, and they are:

- **Creating a new but blank graph page.** Creates a new page with attributes from the template applied.
- **Copying a graph page from one notebook section to another.** Creates a new page in a section, using the data in the existing worksheet for graphs.
- **Overwriting an existing page.** Replaces the existing page.

Creating a New Page with Attributes from a Template

Here you create the graph page first, and then apply the template to it, and then create the graph using your worksheet.

1. Click the and then click **New**.

   > **DANGER:**
   > Do not select a sub menu! Stick with **New**.

2. In the **New** dialog box, select **Graph Page** from the **New** drop-down list.

   Under **Type**, you'll see a list of existing page and graph templates.
3. Select a page template (and not a graph template – see Important! below) and click **OK**. Now you have a blank graph page with the template attributes applied.
4. Right-click this graph page, and click **Create Graph**.

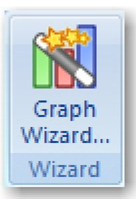
The Graph Wizard appears. Now you can create your graph following the standard procedures.

Important:
To apply a graph template, select one of the graph templates in the **Type** drop-down list on the **New** dialog box. On the graph page, right-click the empty graph (that's the template) and click **Modify Plot**. Follow the prompts of the Graph Wizard.

Copying a Graph Page to use as a Template

The best method of applying a page template to a worksheet is to use an existing graph page as a template. The copied page acts as a template using the worksheet in the new section. For more information, see Copying and Pasting to Create New Sections *(on page 144)*.

If you plan to copy a page, set up your worksheet so that the data is in the appropriate columns before applying the template. You can also change the columns to plot after applying a template by selecting the plot, clicking the **Create Graph** tab, and clicking **Graph Wizard** in the **Wizard** group. For more information, see Picking Different Data for the Current Plot *(on page 83)*.



Overwriting an Existing Page

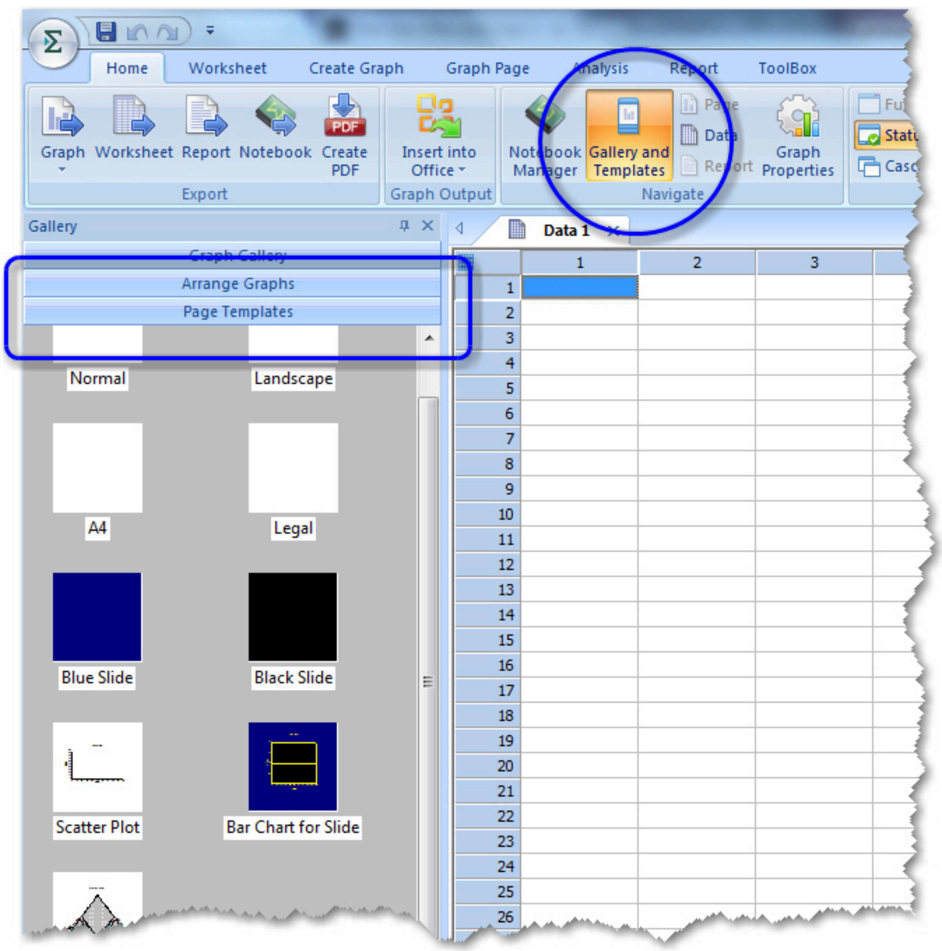
When you apply a template to an existing graph page, all features of the existing page are lost.

1. To apply a template to an existing page:
   a. Make the graph page the active window.
   b. Click the and then click **Templates**.
   c. In the **Templates** dialog box, select a template from the **Templates** list.
   d. Click **Apply**.
2. To apply a template from a different notebook template file:

a. Click the and then click **Templates**.
b. In the **Templates** dialog box, select the path and file name of the desired SigmaPlot Notebook or template file.
c. Click **Open**.
d. Select a template from the **Templates** list in the **Templates** dialog box.
e. Click **Apply**.

Templates and Notebooks

Templates are stored on the **Gallery** tab on the **Notebook Manager**. To quickly find the available templates, click **Gallery and Templates** in the **Navigate** group on the **Home** tab. Then click **Page Templates** on the left-hand side of the SigmaPlot desktop.



Changing the Page Created with the New Page Button

Anytime you click the and then **New** and then **Graph Page**, you'll see that SigmaPlot automatically uses by default the **Normal** template as the source for that specific graph page; however, there are many templates available under the **Type** drop-down list. Just be forewarned that selecting a template here only works for the graph page you are about to create, and not for all subsequent pages.

Changing the Template File Used for New Pages

SigmaPlot automatically uses the template notebook when you open a graph or graph page. You can set this file name in the **General** tab of the **Options** dialog box.

To change the source file template:

1. Click the .
2. Click **Options**.
3. On the **Options** dialog box, click the **General** tab.

4. Type the path and file name of the desired template file in the **Template File** field.
5. Click **OK**. The notebook becomes the default template source.

> **Tip:**
> If a valid default template source file is not specified, a default page is created instead. This page is a letter-sized, white portrait page by default.

Adding New Pages to Template.jnt

You can add a previously created page to Template.jnt, but first you must open Template.jnt in the Notebook Manager.

1. Click the and then **Open**.
2. In the **Open** dialog box, select **Template Notebook (*jnt)** as the file type to view.
3. Select **Select.jnt** and click **Open**.
   TEMPLATE.JNT appears in the Notebook Manager.

   Now you can copy and paste any page you've already created into either the Blank Templates or Graph Templates section of the Templates notebook.

Cutting, Copying, and Pasting Graphs and other Page Objects

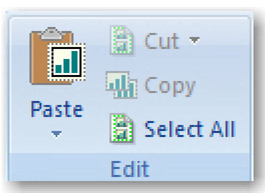
Cut and copy selected page objects to the **Clipboard**.

Cutting and Copying Graphs

The easiest way to cut or copy a graph or other page object select the graph or object to cut or copy by clicking it. To cut the item, press **Ctrl+X**. To copy, press **Ctrl+C** and to paste, press **Ctrl+P**.

A copy of the selected graph or object or is placed in the Clipboard. Since copied items remain in the Clipboard until replaced, you can paste as many copies as you want without having to cut or copy the object each time.

You can also use the buttons available in the **Edit** group on the **Graph Page** tab.



Pasting Objects

You can paste Clipboard contents to any open page, report, or into any other Windows application that supports Windows Metafiles.

To paste an object to a page, click where you want the object to appear, then press **Ctrl+V**.

Note:
The Clipboard is a Microsoft Windows feature. To learn more about how the Clipboard works, refer to your Windows *User's Guide*.

Storing and Retrieving Plot Data and Attributes in Graphs and Pages

All of SigmaPlot's graph pages, the graphs themselves, and templates store data in one way or another. For example, graph pages use worksheet data for plots and labeling; templates store graph attributes for a given graph page; some graphs, like result graphs from statistical procedures, store their own data. Using standard copy and paste keyboard commands, you can convert one from one form of data storage to another.

Creating a Graph that Stores its Own Data

You can create a graph that is visually the same as the original graph but stores its own data.

1. Copy a worksheet graph.
2. Paste it onto another graph page contained in a section without a worksheet.

Creating a Graph Template that Stores Attributes for Graphs on a Page

You can copy any page template into another section with a worksheet and select data for it using the Modify Plot Wizard. In other words, you use it to create graphs with customized attributes as with graphs in the file template.jnt, SigmaPlot's template interface.

1. Copy a graph page with one or more worksheet graphs from the Notebook Manager.
2. Paste it into a notebook section without a worksheet.

A graph page appears with no data.

Creating a Worksheet from a Graph that Stores its Own Data

You can create a new worksheet graph in which the data for the original graph appears in a new worksheet. This new worksheet is what stores the data for the new graph, so as to not overwrite the original.

1. Copy a graph that stores its own data, such as a Result Graph.
2. Paste it onto another graph page in a section with a worksheet.

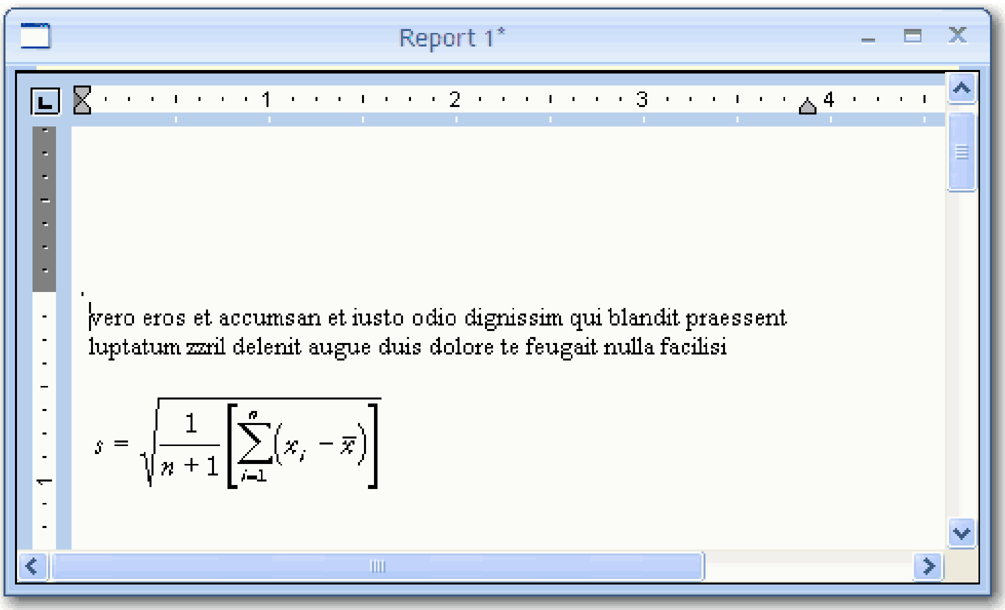
Using OLE to Paste, Link and Embed Objects

There are various ways to paste SigmaPlot objects into other applications, and vice versa. One method is using OLE (Object Linking and Embedding). OLE provides the ability to move or copy information among supporting applications, and to use the applications interchangeably to modify the data.

SigmaPlot and OLE

SigmaPlot can place and receive OLE and other types of objects, such as scanned images, clip art, or text from a word processor. For example, you can place an equation created with the Microsoft Word Equation Editor into a SigmaPlot report, and edit it with the Word Equation Editor when it changes.

Figure 30. Example of an Microsoft Excel Equation Embedded into a SigmaPlot Report



Methods Of Placing Objects

You can copy, cut, and paste graphs among applications without using OLE. The method of placing objects depends on each application's implementation. The following list shows how objects can be placed:

- **OLE object.** Can be placed if application supports OLE.
- **Windows Metafile.** Can be placed if application doesn't support OLE, but supports pictures.
- **Enhanced Metafile.** Can be placed in Windows applications only.
- **Bitmap.** Can be pasted in applications that support bitmaps only (for example, Microsoft Paint).

Note:
SigmaPlot always pastes an OLE object if it is available. The SigmaPlot graph and report pages support OLE. Graphs (not graph pages) pasted into SigmaPlot reports are always pasted as Windows metafiles.

Linking or Embedding Objects

Use **Paste Special**, **Insert Object** , and **Ctrl+Drag** to either link or embed the object in the page or report.

Linking appears to place a copy of the object in the destination application, but actually only places a reference to it. Therefore, the object is modified every time the original file is modified.

You can only link to a file if you create an object using the **Paste Special** in the **Edit** group or **Insert New Object** in the **Insert**group, both on the **Graph Page** tab, or if you drag and drop an object with the Ctrl key held down.

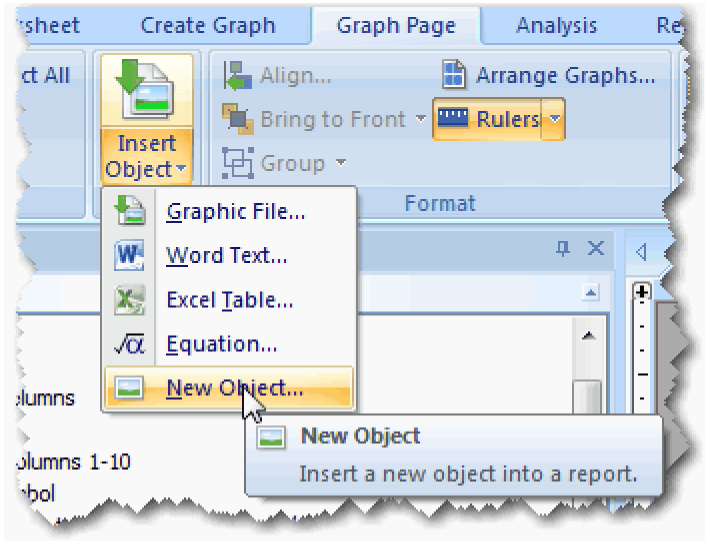
Linking is useful when you need to update an embedded object when the file is updated. The disadvantage of linking objects is that you cannot open a referenced file if the locations of either the SigmaPlot file and the source file change.

Embedding places a copy of the object in the destination application, and then you can edit it by activating its source application when you double-click it. Embedding does not use a reference file; the "file" is actually embedded completely in the SigmaPlot file. For example, if a Microsoft Word embedded object has been placed in a SigmaPlot report, and you double-click it, Microsoft Word opens. Word temporarily runs under SigmaPlot. When you are finished editing the item and close Word, SigmaPlot remains open.

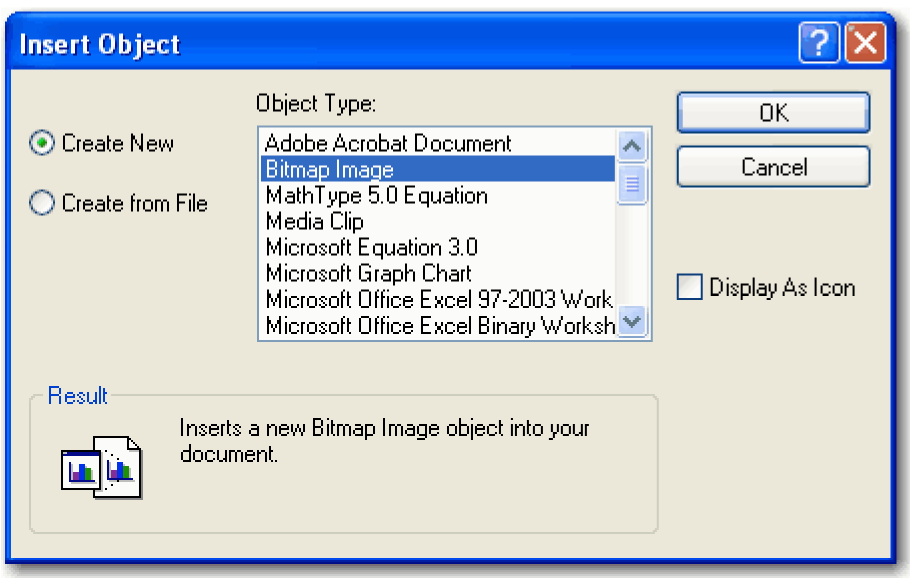
Embedding an object has the advantage of keeping all the associated data in one place, but can create large files.

To embed an object:

1. With a graph page in view, on the **Graph Page** tab, in the **Insert** group, click **Insert Object**.



2. Click **Insert Object** from the drop-down list.
3. In the **New Object** dialog box, select the type of object to insert from the **Object Type** list. A description of the object type appears below.



4. Click **OK** to insert the object.

Placing SigmaPlot Objects into Other Applications

You can paste SigmaPlot graphs and reports into other applications, and link or embed them for future editing with SigmaPlot. For example, you can paste a SigmaPlot graph into a Microsoft Word document (as an OLE object), and use Graph Properties to edit it by double-clicking the graph.

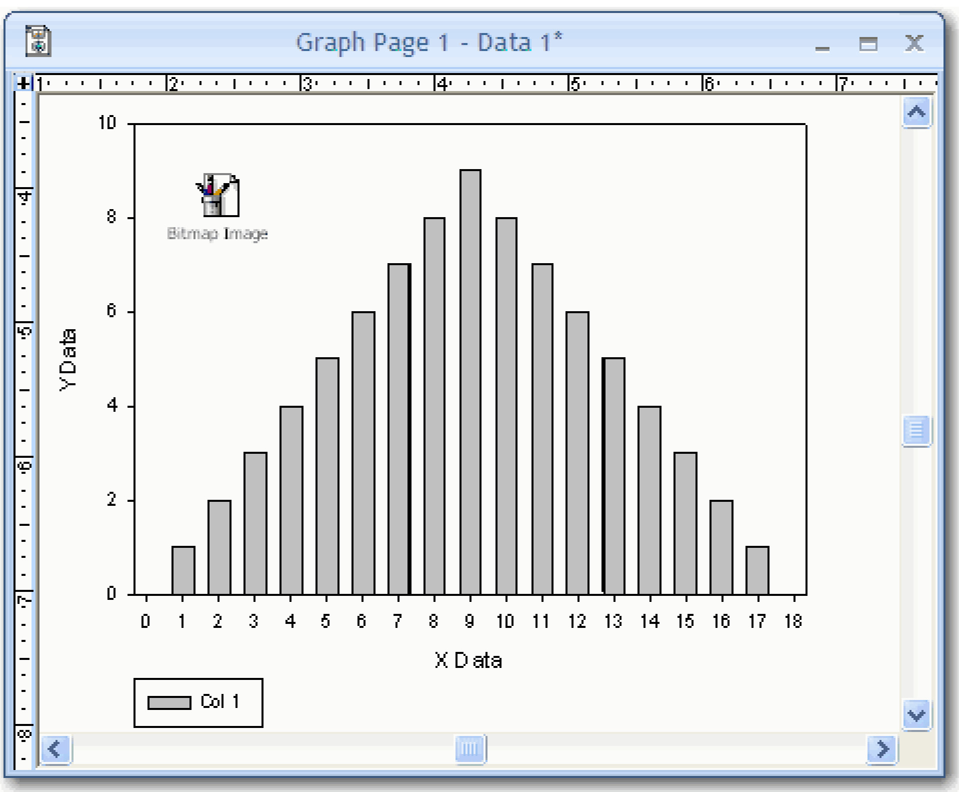
When you link to SigmaPlot and double-click the graph or report, the notebook file containing the graph or report opens.

You can change the source of any linked object. For more information, see Dragging and Dropping Graphs *(on page 171)*.

View as Icon

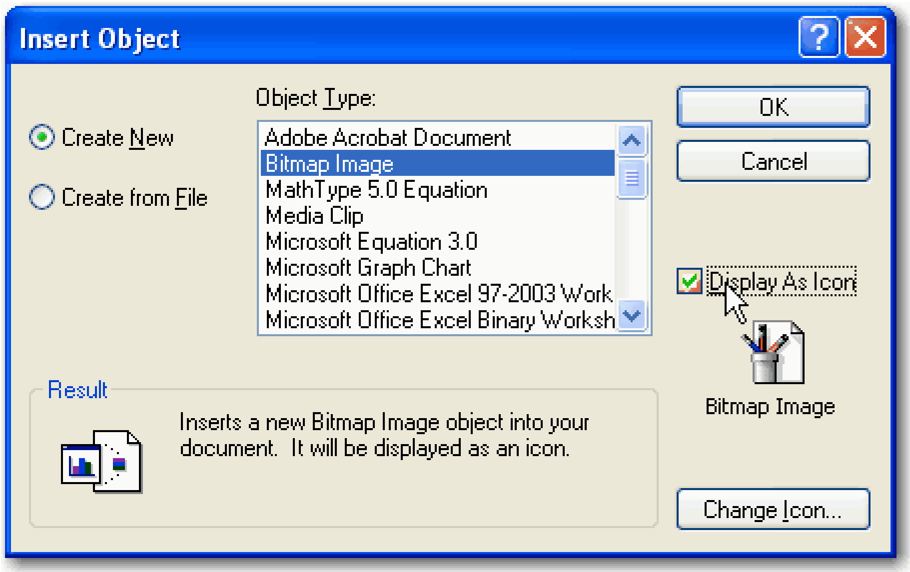
With OLE, the **View as Icon** allows you to place an icon representing the application that created the file in your data. For example, if you have a description of a graph written in a Microsoft Word document, you can embed it, and display it as an icon that shows on the graph page. If you want the object displayed as an icon, select the **Display As Icon** option. Click the icon to view and edit the object in its source application.

Figure 31. Displaying a Microsoft Word Document as an Icon on a Graph Page



To embed the object and view as an icon:

1. With a graph view, on the **Graph Page** tab, in the **Insert Group**, click the **Insert Object** drop-down list.
2. Click **Insert Object**
3. In the **Insert Object** dialog box, select the type of object to insert from the **Object** drop-down list.



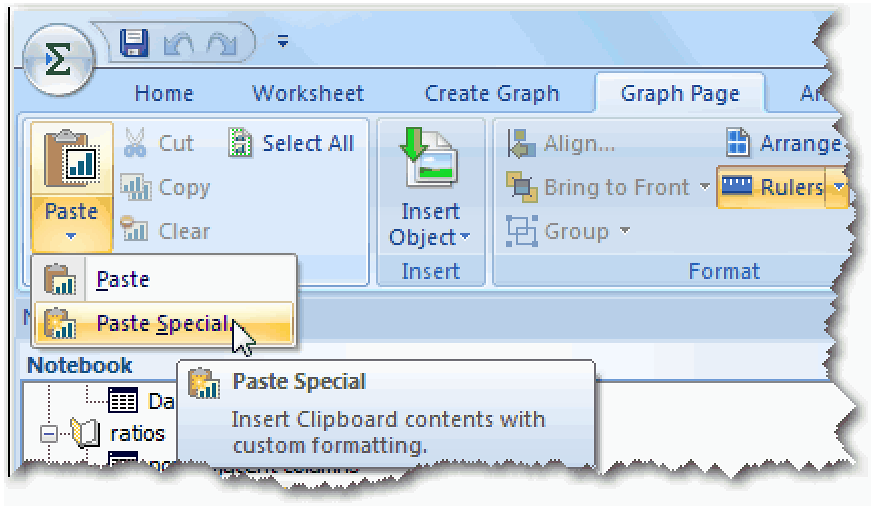
4. Select **Display as Icon**.
5. Click **OK** to insert the object as an icon.

Pasting Objects onto a Graph Page or Report

You can paste contents, including OLE objects, into both page and report documents.

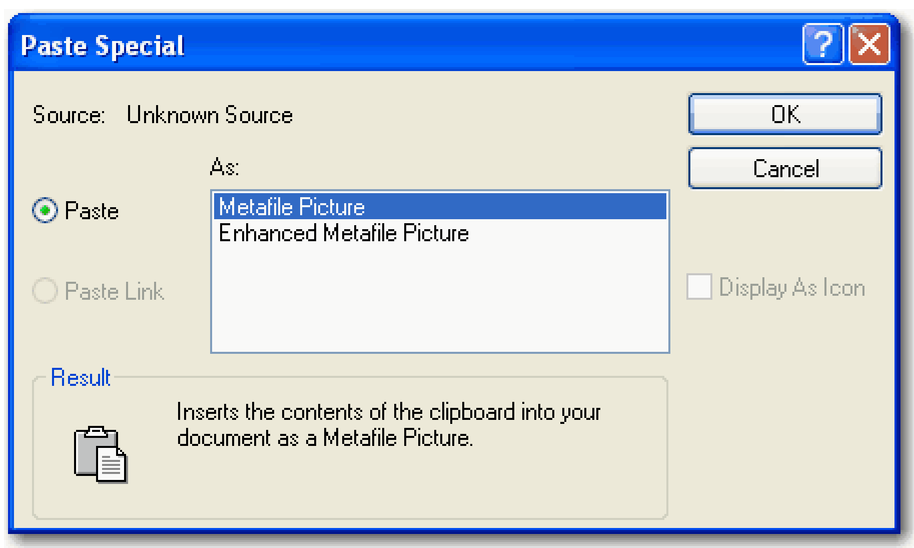
To paste artwork, text from a word processing application, or other objects onto a graph or report page:

1. Open the application and file containing the desired artwork or text, and cut or copy the object.
2. Switch to SigmaPlot and view the graph or report page.
3. Click the location where you want the object to appear, then press **Ctrl+V**. The graphic is pasted to the page. If the object can be an OLE object, SigmaPlot always defaults to the OLE object.
4. To paste the object as a specified file type, on the **Graph Page** tab, in the **Edit** group, click the **Paste** drop-down list.



5. Select the type of object to paste from the **As** box, then click **OK**. The object appears at the selected location.
6. Click **Paste Special**.

Figure 32. Using the Paste Special Dialog Box to Paste an Object from Microsoft Word to SigmaPlot



Restriction:
The options available in the **Paste Special** dialog box depend on the type of file being pasted.

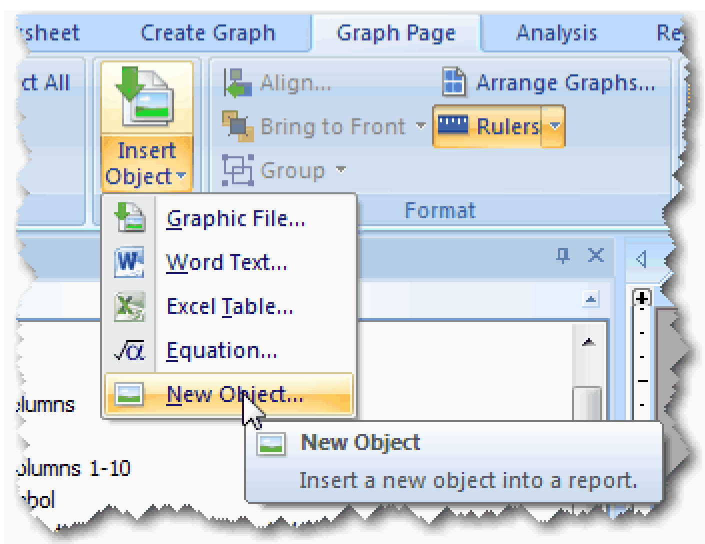
7. Select **Paste** to paste the object as a specified file type. Select **Paste Link** to paste the object as a linked file that can be updated in another application. The options in the **As** list change depending on your selection of either **Paste** or **Paste Link**, and the explanation in the Result box changes depending on your selection in the **As** list.
8. Select the type of object to paste from the **As** box, then click **OK**. The object appears at the selected location.

Placing Objects without the Clipboard

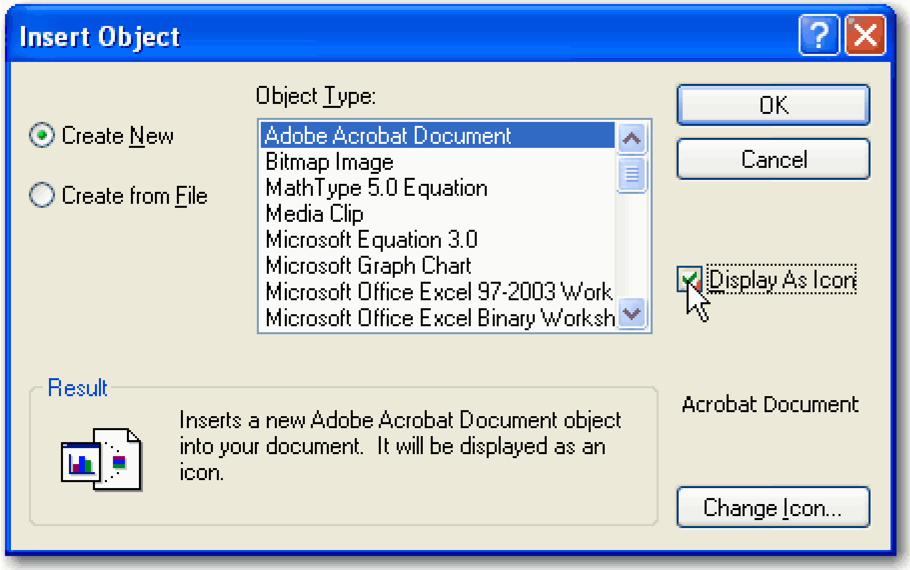
You can select objects from applications that are installed on your system and to place them into a SigmaPlot graph or report. The object types available on your system depend on the applications installed.

To insert an object:

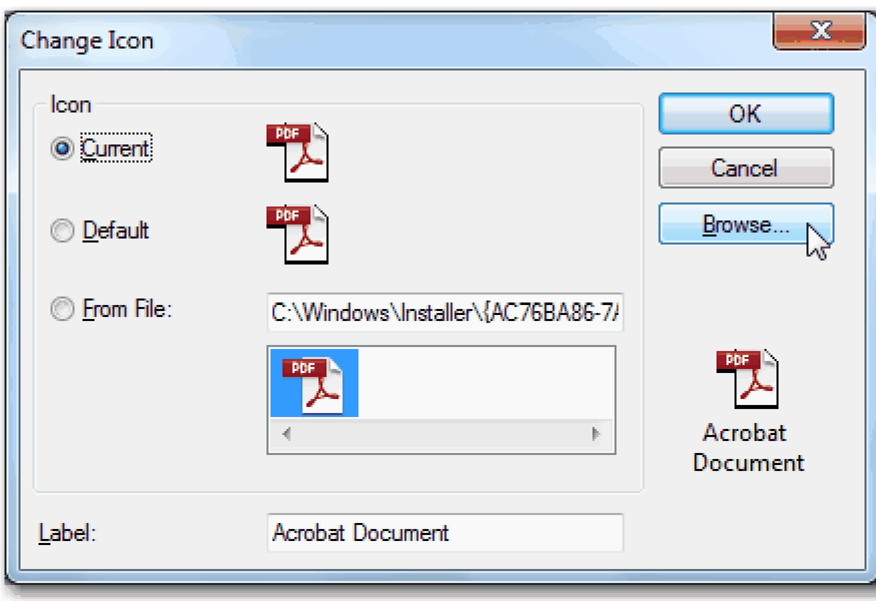
1. View the report or graph page, and click where you want the insertion point.
2. On the **Graph Page** tab, in the **Insert** group, click the **Insert Object** drop-down list.
3. Click **Insert Object**.



4. If you want to display the new object as an icon, select **Display As Icon** in the **Insert Object** dialog box.



You can also specify a different icon to display the inserted object. Click **Change Icon** to open the **Change Icon** dialog box. Choose a different icon from the available options, or click the **Browse** button to search for alternative icons on your system.



5. **To create a new object to place on the report or graph page,** select **Create New**, then choose the type of object from the **Object Type** list.
6. Click **OK** to open the application associated with the selected object. Create the desired object, then close the application and return to SigmaPlot. The created object is displayed on the graph or report page as an embedded object.

Dragging and Dropping Graphs

You can drag objects between compatible applications within Windows. Additionally, you can drag and drop graphs from one graph page to another.

To drag a graph into another application, the other application must support OLE.

1. Make sure the other application is open and visible from the desktop, with the location where you want to drop the graph also visible.
2. Select the SigmaPlot graph you want placed in the other program, then drag the graph from the SigmaPlot page. If you want to drop a copy of the graph, press the Ctrl key while dragging.
3. Move the mouse to the location you want the SigmaPlot graph to appear.
4. Release the mouse; the graph appears at the drop location as an enhanced meta file.

Dragging and Dropping Graphs Between Pages

You can drag a graph from one graph page to another. If you drag a graph from a different notebook section, it will insert its data into the destination section worksheet.

To copy or move a graph from one graph page to another:

1. Open the source and destination pages.
2. Release the mouse where you want the graph to appear. The graph is placed on the new page. If the page is in a different section, the data plotted by the graph is copied to the current worksheet.

Hiding and Deleting Objects from the Page

You can delete drawn and pasted page objects from the page, and graphs, automatic legends, automatically created graph titles, plots, and axes can be deleted and/or hidden from view.

Hiding and Viewing Graphs on a Page

The quickest way to hide a graph on page is to select the graph page, then right-click the graph you want to hide, and on the shortcut menu, click Hide.

To control which graphs are displayed on the page:

1. Click the , click **Print**, and then click **Page Setup**.

2. Click the **Page Layout** tab. The graphs on the current page are listed in the Shown box.
3. **To hide a graph,** select it from the list and click **Hide**. The selected graph is moved to the **Hidden** list. (To select multiple graphs, hold down the Shift or Ctrl key while making selections.)
4. Click **OK** to apply your selections and close the **Page Setup** dialog box.

> **Note:**
> Hidden graphs do not print.

Hiding Graph Titles and Legends

You can hide automatically generated graph and axis titles and legends from view without being permanently removed from the graph page.

To hide an automatic legend or automatically created graph title:

Right-click the legend or title and then on the shortcut menu click **Hide**. The title or legend is not deleted, only hidden.

Removing Graphs, Plots, Titles, Legends, and Other Page Objects

Anything on the graph page can be removed from the page by selecting the object, then pressing **Delete**.

Deleting removes curves, plots, and graphs entirely. You can use undo (Ctrl+Z) to retrieve these items. When a graph or plot is removed, worksheet data remains intact. Delete also completely removes drawn and pasted objects.

> **Note:**
> Delete only hides titles and legends, and does not remove them permanently.

Drawing Objects on the Page

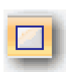
Use the tools available on the **Tools** group of the **Graph Page** tab to draw rectangles, ellipses, lines, and arrows.

Any drawn object or text is not attached to the graph until they are grouped with the graph.

Graph Page Tools

Use the **Tools** group on the **Graph Page** tab to draw objects on the graph page.

The drawing tools on the **Tools** group are:

	**Select Object**	Use the Select Object button to select objects on the graph page.
	**Text**	Click this button to add text, labels, or manually created legends to the graph page.
	**Draw Line**	Click this button to draw a line on the graph page.
	**Draw Arrow**	Click this button to draw an arrow on the graph page.
	**Draw Box**	Use the Draw Box button to draw a box on the graph page.
	**Draw Ellipse**	Click this button to draw an ellipse on the graph page.

Drawing an Object

To draw an object:

1. Click a drawing tool in the **Tools** group on the **Graph Page** tab. The pointer has a crosshair appearance when over the graph page.
2. Release the mouse button to finish drawing the object.

Modifying Object Colors and Lines

Use the tools available below the drawing tools on the **Tools** group on the **Graph Page** tab to modify line type, thickness, color, line end appearance (arrow heads, etcetera), object fill color, pattern, and pattern color.

Changing Object Fills

Change fill patterns and colors of drawn rectangles and ellipses, and of graph symbols, bars, and boxes using the **Tools** group on the **Graph PageGraph** tab

> **Note:**
> When you select multiple objects, fill options apply to all selected objects that can be filled, including lines.

To change the background color of an object fill:

1. Select the object(s) to modify on the graph page.
2. In the **Tools** group on the **Graph Page** tab, click **Fill Color**.

Changing Lines

For drawn lines and graph lines, you can change line type, color, and thickness. For more information, see Using Custom Colors and Incrementing Schemes *(on page 199)*.

To change line color:

1. Select the object(s) to modify on the graph page.
2. In the **Tools** group on the **Graph Page** tab, click **Line Color**.
3. **To change line type and thickness**, click **Line Thickness**.

Changing Line Ending Attributes

Edit line ending attributes for existing lines and arrows, or set the default line endings for drawn arrows. Line ending attributes affect only plain lines and arrows, not graph lines.

To change line ending attributes:

1. Select the line(s) to modify:
2. In the **Tools** group on the **Graph Page** tab, click **Line End**.

Moving and Sizing Graphs and Objects

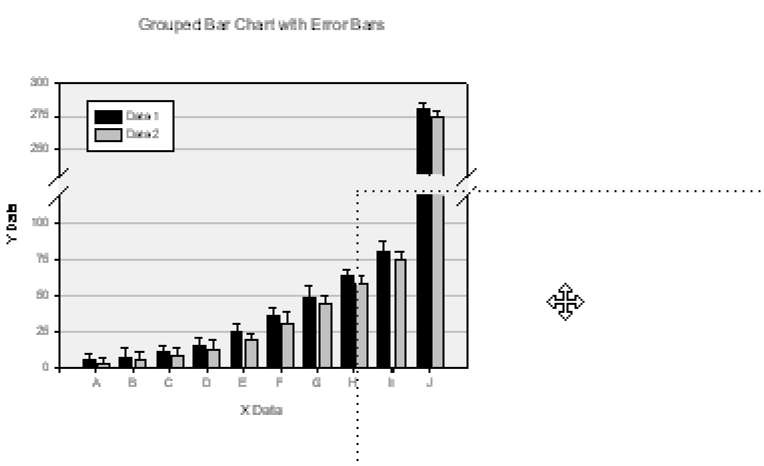
You can modify graph or object size and position either by using your mouse on the page, or by setting specific position, size, and scaling options in **Object Properties**.

1. Double-click the object.
2. In the **Object Properties** dialog box, click the **Size and Position** tab.
3. **To set the distance of the selected object from the top and the left of the page,** under **Position**, move the **Top** and **Left** sliders or type new values in the **Top** and **Left** boxes.
4. **To change the size of the selected object,** under **Size**, move the **Height** and **Width** sliders to set the size to specific measurements, or scale the object to a new size by typing a percentage in the **Height** and **Width** boxes.

Using Your Mouse to Move Graphs and Objects

When you use your mouse to move graphs, graph titles, axis labels, and automatic legends are automatically grouped with a graph and move with it. You can move graphs and objects to other page windows.

Figure 33. Moving a Graph



To move a graph or object with your mouse:

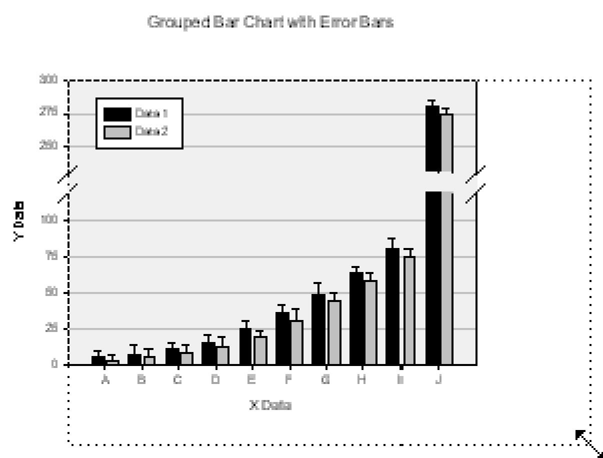
1. Select the desired graph.
2. Release the mouse button. The graph moves to the new position.

Using Your Mouse to Change Graph and Object Size

The easiest way to adjust the size and shape of a graph is to resize the graph using the mouse. You can also specify proportional scaling of graphs and objects so that the height and width ratios are maintained, and choose to rescale graph and axis titles and tick marks accordingly.

To adjust graph or object size with the mouse:

1. View the page window.
2. Click the graph or desired objects to select them. Selected page objects are surrounded with small square handles. Place the pointer over a handle.
3. Press and hold down the left mouse button to drag the handle to a new location. The shape of the pointer changes when you move it over a handle, indicating the direction you can stretch the graph or object.
   Drag a side handle to stretch or shrink an object horizontally, drag a top or bottom handle to stretch or shrink an object vertically, or drag a corner handle to stretch an object two-dimensionally. A dotted outline of the resized graph or object follows the pointer position.



Dragging a corner handle preserves the aspect ratio (relative height and width) of objects by default. Also, graph text, symbols and tick marks are rescaled along with the graph. For more information, see Graph Page Basics *(on page 148)*.

4. Release the mouse button when finished. The graph or object resizes to the indicated size.

> **Remember:**
> Unlike graphs and drawn objects, you cannot stretch or shrink text labels manually. To resize text, change the font size. For more information, see Editing Text *(on page 183)*.

Nudging Graphs and Objects

You can use your keyboard arrow keys to move graphs and objects on a graph page. Select the object using your mouse, and then move the object by using the arrow keys. You can also select objects by pressing the Tab key. Press Shift+Tab to scroll back. Press Shift+Arrow to select multiple objects.

Pressing an arrow key moves the graph or object one point, or .014in. You can change this default setting in the **spw.ini file**. If you have activated **Snap-to** grids, nudge will not work unless you set the nudge value to be greater than or equal to the Snap-to value.

You cannot nudge computable objects, such as plots and all parts of plots, tick marks, and regression, reference, and grid lines.

Moving Objects to the Front or Back

You can move selected objects so that they appear in front of or behind other page objects.

To move an object to the front or back:

1. Select the object to move by clicking it.
2. **To move the selected object to the foreground,** on the **Graph Page** tab, in the **Format** group, click **Bring to Front**. The selected object is drawn in front of all other objects.
3. **To move the selected object to the background,** on the **Graph Page** tab, in the **Format** group, click the **Bring to Front** drop-down list, and then click **Send to Back**. The selected object is drawn behind all other objects.

> **Note:**
> If you select more than one object, the selected objects remain in their relative front to back positions. Grouped objects, including titles and legends with graphs, move as a single object.

Grouping and Ungrouping Objects

You can move and modify selected items on the page by grouping multiple objects as one object. To individually modify grouped objects, you must ungroup them first. Objects and text must be grouped with the graph for them to stay in place, and move with the graph if you shift the graph's location.

Note:
To learn how to ungroup legend items, see Moving Individual Legend Entries *(on page 187)*.

1. To group and ungroup objects:
   a. On the **Graph Page** tab, in the **Tools** group, click **Select Object**.
   b. On the **Graph Page** tab, in the **Format** group, click the **Group** drop-down list, and then click **Ungroup**. If you have grouped a group, you may need to ungroup the objects as many times as they have been grouped.
   c. Select the graph, by clicking it, if you wish to attach the graph to the objects or text.
   d. Select the objects and text to group by holding down the Shift key while selecting individual objects. Handles appear around the graph and each selected object.
   e. On the **Graph Page** tab, in the **Format** group, click the **Group** drop-down list, and then click **Group**. The Group button is available only when more than one object is selected. All selected objects are grouped and can be selected, moved, sized, aligned, and positioned as a single object.
2. To ungroup objects on a graph page:
   a. On the **Graph Page** tab, in the **Format** group, click the **Group** drop-down list, and then click **Ungroup**. If you have grouped a group, you may need to ungroup the objects as many times as they have been grouped.
   b. Select the group.
   c. On the **Graph Page** tab, in the **Format** group, click the **Group** drop-down list, and then click **Ungroup**. If you have grouped a group, you may need to ungroup the objects as many times as they have been grouped.

Arranging Graphs

Use the **Arrange Graph** dialog box to quickly arrange, resize, and set positions of multiple graphs on a page.

Arranging Graphs on a Page

1. Select the graph page.
2. On the **Graph Page** tab, in the **Format Group** group, click **Arrange Graph**.
3. In the **Arrange Graphs** dialog box, select a layout for the page from the **Layouts** list. A preview of the layout appears in the **Preview** window.
   Layouts are stored in a template file called **Layouts.jnt**.

   > **Note:**
   > You must apply a layout to a page that has the same or fewer number of graphs.

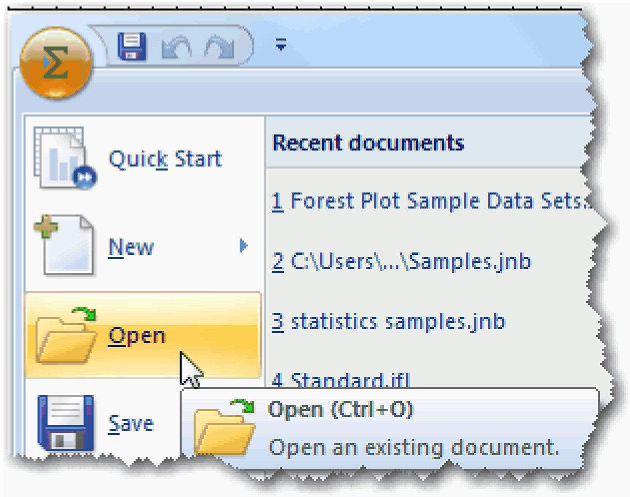
4. Click **Apply**. The graphs on the page match the layout you selected, and the **Layout** dialog box remains open.
5. To arrange the graphs again, you can select another layout from the **Layouts** list, then click **Apply**, or click **Close** to close the dialog box.

Adding New Pages to Layout.jnt

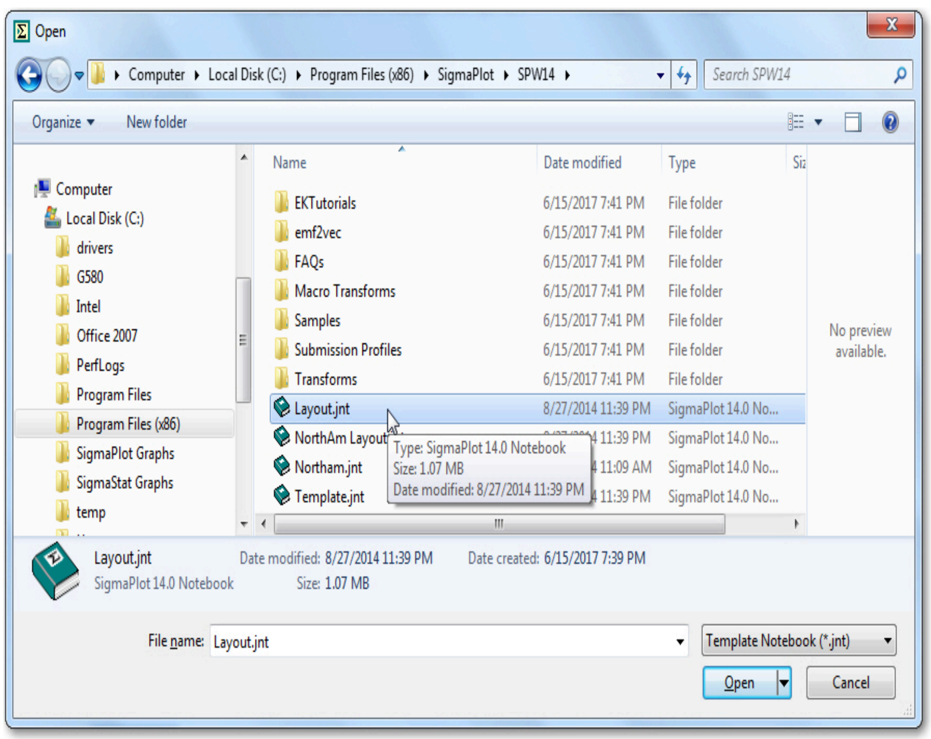
Layouts, like templates, use a .jnt extension and are stored in notebooks. A sample layout notebook, **layout.jnt**, is provided with SigmaPlot and is set as the default layout source notebook. You can add a your own graph page to this file to use the next time you arrange graphs on the page. For more information, see Applying Templates *(on page 157)*.

To add a page:

1. Click the **Main Button** and then click **Open**.

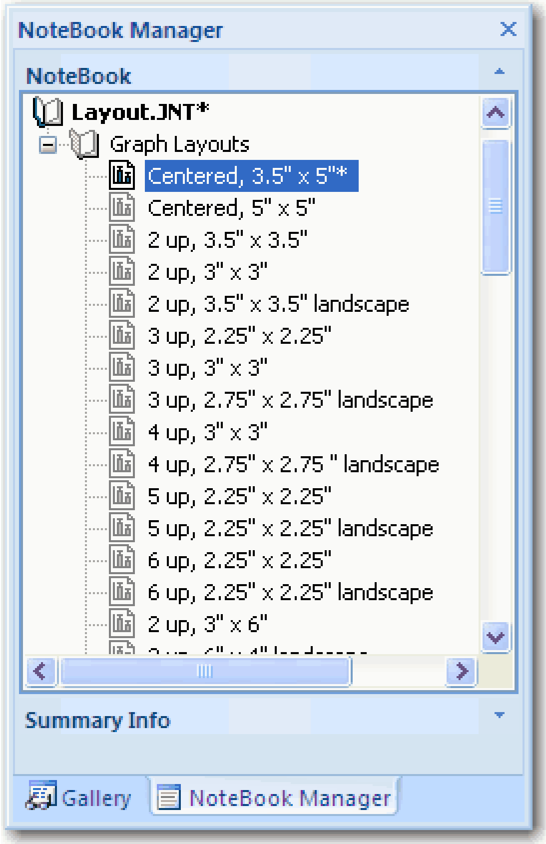


2. In the **Open** dialog box, select **Template Notebook (*.jnt)** from the **Files of type** drop-down list.



3. Select **Layout.jnt** from the **SPW15** folder. For more information, see About SigmaPlot's User and Program Files *(on page 21)*.

4. Click **Open**. The **Layout.jnt** notebook appears in the **Notebook Manager**.

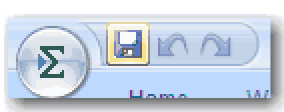


Creating a Custom Layout Template File

You can create and save your own custom layouts by saving a graph page as a .jnt file.

To create your own layout template file:

1. Create a graph page and position the graphs as desired.
2. Click **Save** in the **Quick Access** toolbar.



3. In the **Save As** dialog box, type the name of the new layout template notebook in **File** name box.
4. Click **Save**. Now you can add future layouts to their own separate layout notebook.

Changing the Default Layout Template File

To change the source template file:

1. Click the .
2. Click **Options**.
3. In the **Options** dialog box, click the **General** tab.

4. Type the path and file name of the desired layout file in the **Layout file** field.
5. Click **OK**. The notebook becomes the default layout source.

Aligning Page Objects

You can align labels and objects with each other as well as with graphs and axes.

To align page objects:

1. Select the labels, graphs or other object(s) you want to align by holding down the Shift key while selecting individual objects. (You must select more than one object in order to align them.)
2. On the **Graph Page** tab, in the **Format** group, click **Align**.

3. **Align** dialog box, under **Horizontal** and **Vertical**, choose the appropriate options to align the selected objects vertically, horizontally, or both. Graphical feedback for your selections appears in the lower right corner of the dialog box.
4. **To align selected objects relative to each other,** select **Each Other**.
   You must have multiple objects selected if you want to align selected objects relative to each other. **Each Other** moves aligned objects with respect to the last selected object, which remains in a fixed position. The last selected object can be distinguished from other selected objects by solid rather than hollow selection handles.
5. **To align objects relative to the page margins rather than the page edge**, select **Page Margins**.
6. Click **OK**.

Working with Grids and Rulers

Use grids and rulers to quickly and easily align graphs and objects on the page. You can show or hide grids and rulers from the **Format** group on the **Graph Page** tab.

Using Rulers

Rulers are optionally displayed at the top and left hand side of all graph pages. They display the current units set in the **Options** dialog box. You can choose between inches, centimeters, or points.

Using Snap-to

You can use **Snap-to** if the grids are displayed or hidden. To use grids:

1. On the **Graph Page** tab, in the **Format** group, click the **Rulers > Grid Lines** drop-down list.

2. Click **Snap-to**.
   Graphs and objects snap to the nearest grid.

Using Crosshairs

Use **Crosshairs** as an object alignment tool. To turn on crosshairs, click the **Crosshairs** button on the upper left hand corner of the graph page window. Crosshair lines extend from the pointer tip to the rulers and to the right and bottom of the window, and follow the pointer.

To hide crosshairs, click the **Crosshairs** button again.

Editing Text

Use the mini toolbar**Text** group on the **Graph Page** tab to add and edit text labels and legends to the graph page, in addition to editing automatically created graph and axis titles. SigmaPlot automatically creates legends for every plot. You can format tick or contourlabels, but you cannot edit their content.

To edit a graph title, double-click it to open the **Graph Properties** dialog box. You can edit the title in the **Graph Title** box.

Creating Text Labels

You can add an unlimited number of text labels and legends to any graph page. SigmaPlot supports:

- All TrueType, PostScript, and other fonts installed on your system.
- Multiple lines of text aligned left, right, or centered, with adjustable line heights.
- Mixed fonts and other attributes within a single label.
- Multiple levels of superscripting and subscripting.

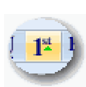
- Rotation of text in single degree increments.
- Color using up to 16.7 million different combinations of red, green, and blue

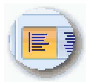
To create text labels or legends on a page:

1. Select and view the page window.
2. Click the **Graph Page** tab, and then in the **Tools** group, click **Text**.

   This places you into text mode until another mode or tool is selected.
3. Click the page where you want the label to begin. A text box appears.
4. Select the font, character size, and other starting character attributes in the **Text** group.

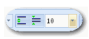
   The following table outlines the functions of each button. These buttons act on selected text, or set the format for following text.

Control	Function
	Set Font
	Set Size
	Normal Format
	Bold
	Italic
	Underlined
	Superscript One Level
	Subscript One Level
	Toggle to Greek (Symbol) Font

 Left Align

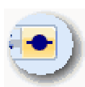
 Center Align

 Right Align

 Line Spacing (Multiline Paragraph Only)

Rotation

 Color

 Legend Symbol

The **Rotation**, **Alignment**, and **Line Spacing** options affect the entire label, not just the selected text, and Line Spacing is a minimum spacing control, not fixed. If you change the height of characters by changing font sizes or by adding superscripts or subscripts, the line height adjusts automatically.

> **Tip:**
> Using the **Default Text Properties** you can set default text label attributes by opening the **Text Properties** dialog box with no labels selected.

> **Tip:**
> In addition to using the **Greek Characters** button to add a Greek symbol to text, you can also select existing text and choose **Symbol** as the font type in the **Text Properties** dialog box.

5. **To add legend symbols to your text,** click **Symbols**. The **Symbol** palette appears.
6. Type your label.

Editing Text and Individual Characters

To edit existing text on a graph page, you can click the text if you are in text mode, or if you are in select mode, double-click the text. For more information, see Selecting Page Objects *(on page 151)*.

Formatting Text

If you want only to change the attributes (the formatting) of selected text on a graph page, use the **Formatting** toolbar. The **Text Properties** dialog box sets properties for all selected labels, and applies changes to all characters within selected labels.

> **CAUTION:**
> If you have complex font and character changes within a label, take care not to overwrite these formats with Text Properties dialog box settings.

Global Text Changes. The **Text Properties** dialog box is useful for formatting multiple labels as well as all text on a graph. Select the graph and choose **Text Properties**, then select the attributes you want applied to all graph labels and titles.

Default Text Properties. The **Text Properties** dialog box is used to set the default character and paragraph properties for new labels. Open the **Text Properties** dialog box with nothing selected, and set the options you want applied to new text labels.

To format text using the Text Properties dialog box:

1. Select the text object you want to modify.
   If you want to modify several text objects, hold down the Shift key while clicking the objects, or drag a select window around all objects.
2. **To change the font, style, character size, or color of text, or to underline text,** click the **Font** tab.

   > **CAUTION:**
   > If you have multiple text objects with different text properties selected, the attributes that are not the same appear blank. Do not select an attribute for these options unless you want it to be applied to all selected objects.

3. **To change paragraph attributes, including line spacing, alignment, or rotation,** click the **Paragraph** tab.
4. Click **OK** to apply the changes and close the dialog box.

Working with Automatic Legends

Legends work as a key for your graph. They label what the different graph symbols, lines, or fills represent. SigmaPlot automatically creates legends for all graphs, always placing them below the graph on the left side. Legend entries are labeled using the titles of the columns plotted; if there are no column titles, column numbers are used instead.

Move and modify legends as you would any other page object. They also have a special set of controls and features. This section describes how to modify and control these automatic legend features.

You can also add legend symbols to any text label or title.

Editing Individual Legend Entries

To edit legend entries:

1. Select the legend on the graph page.
2. Click the **Graph Page Graph Page** tab, and then use the properties available in the **Text** group.

Moving Individual Legend Entries

To move an individual legend entry:

1. Select the legend entry.
2. Press the Up or Down Arrow keys to move the entry to your desired location.

> **Important:**
> Press the left mouse button to regain pointer access to the graph page.

Sizing Legend Symbols

You can individually control legend symbol size using **Graph Properties** or you can just as easily use the pop-up menu that appears when you hover the pointer over the legend.

To resize legend symbols:

1. Select the entry in the legend.
2. On the pop-up menu that appears, click the **Legend Symbols** button.

   The **Symbol** dialog box appears.
3. Under **Symbols**, select the symbol you would like to modify.
4. Control the symbol size and width using the **Symbol Height** and **Symbol Width** sliders.
5. Click **OK** when finished to close the dialog box.

Editing Automatic Legends using Graph Properties

You can edit a legend as a single object using **Graph Properties**.

To edit an automatic legend:

1. Double-click the graph to open **Graph Properties**.
2. In the **Properties** list select: **Graph > Legends**
3. **To show or hide an automatic legend,** under **Legend properties**, select or clear **Show legend**.
4. **To enclose the legend in a box,** under **Legend properties**, select **Framed in box**.
5. **To hide a legend box,** under **Legend properties**, clear **Framed in box**.
6. **To modify the line thickness and fill of the legend box,** under **Legend properties**, click **Box** to open the **Object Properties** dialog box.
7. **To show or hide individual legend entries for a specific plot or curve,** under **Legend appearance**, select or clear a legend entry from the **For legend symbol** list.
8. **To annotate:** Do this for as many legend symbols as you want.
   a. Select the symbol from the **For legend symbol** drop-down list.
   b. Under **Legend title**, click **Title**.
   c. Then type text in the **Edit Text** dialog box and click **OK**.
9. **To move the legend symbols either to the right or to the left of text,** select a position from the **Symbol placement** drop-down list. If you have no legend symbol selected, this operates on all legends. If you select a specific entry from the **For legend symbol** list, this option affects only that symbol.
10. **To modify the appearance of the symbols for the current legend,** select a symbol style from the **Style** drop-down list.

The **Style** drop-down list only affects scatter and line plots. If you have no legend symbol selected, this operates on all symbols. If you select a specific entry from the For symbol list, this option affects only that symbol.

11. **To change the text size or style,** click **Font** under **Legend properties**. The **Text Properties** dialog box appears.

Permanently Displaying and Hiding Automatic Legends

You can control the display of automatic legends either for all subsequently created graphs.

To view or hide automatic legends for all subsequently created plots:

1. Click the .
2. Click **Options**.
3. Click the **General** tab.
4. Select **Automatic legends** to display the legend, or clear it to hide the legend.

Locking Legend Text

Locking legends halts all automatic updating of the legend text for the whole legend. For example, if you lock the legend, you can change column titles and column data without resetting the legend label. The legend will automatically update, however, if you remove or add a curve.

You can also lock a legend by editing it.

If you do not lock the legend, the legend automatically updates itself when you change column titles and data. Locking the legend affects the entire legend, not just individual entries.

To lock legend text:

1. Double-click the graph to open **Graph Properties**.
2. In the **Properties** list, select **Graph > Legends**.
3. Under **Legend properties** select **Lock legend**.

Reordering Legend Entries

1. Double-click the graph to open **Graph Properties**.
2. In the **Properties** list, select **Graph > Legends**.
3. Select a legend entry under **For legend symbol**.

4. Click either the **Up** or **Down** arrow to move the entry to its desired location.

Setting Legend Columns

To set the number of legend columns:

1. Double-click the graph to open **Graph Properties**.
2. In the **Properties** list, select **Graph > Legends**.
3. Select your desired number of columns from the **Column count** drop-down list.

Direct Labeling of Legend Items

You can ungroup the legend move individual legend items to exact locations on the graph. To do so:

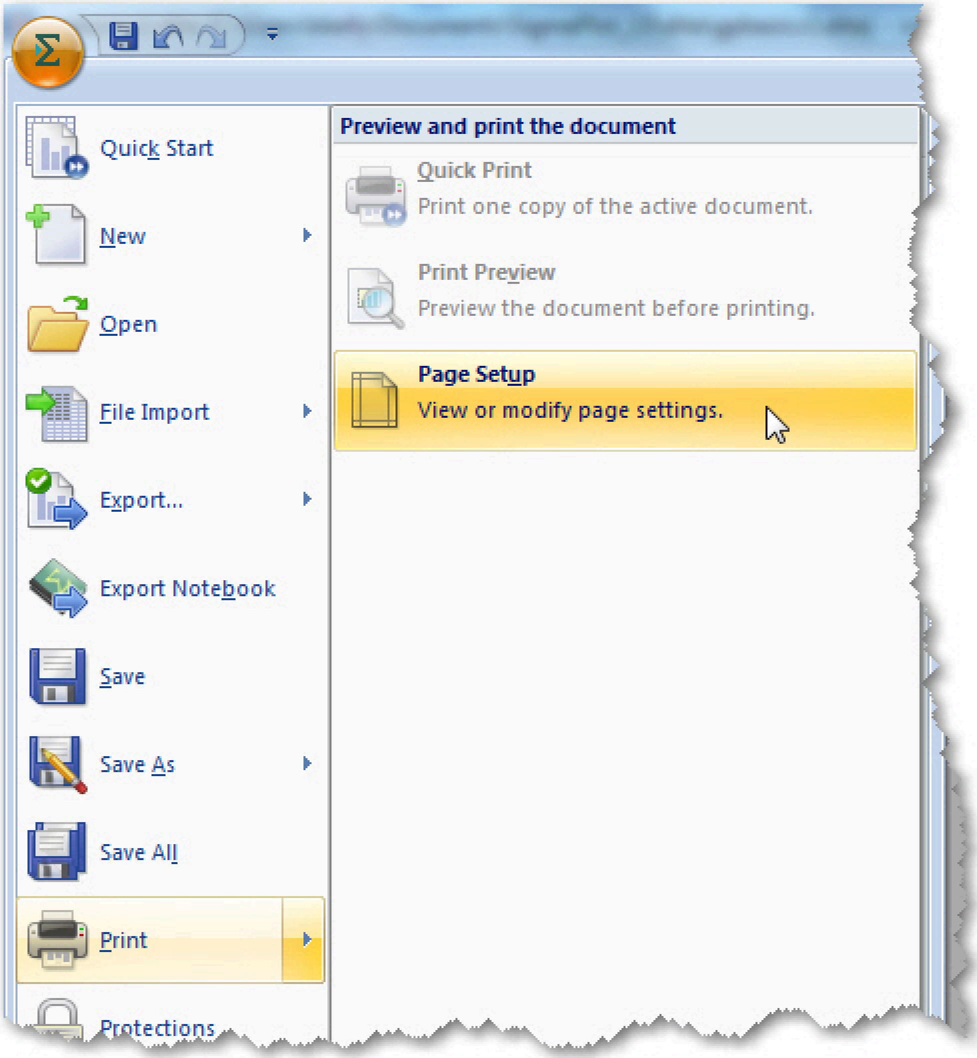
1. Double-click the graph to open **Graph Properties**.
2. In the **Properties** list, select **Graph > Legends**.
3. Select **Direct Labeling** under **Legend Properties**.
4. Close **Graph Properties**.
5. You can now select the entry in the legend and drag it to where you'd like it to appear on the graph page.

Changing Graph Page Format

Use the **Page Setup** dialog box to change graph page margins and size. This dialog box also controls which graphs on a page are displayed or hidden from view, and the color of the page. For more information, see Hiding and Deleting Objects from the Page *(on page 171)*.

To change graph page margins and size:

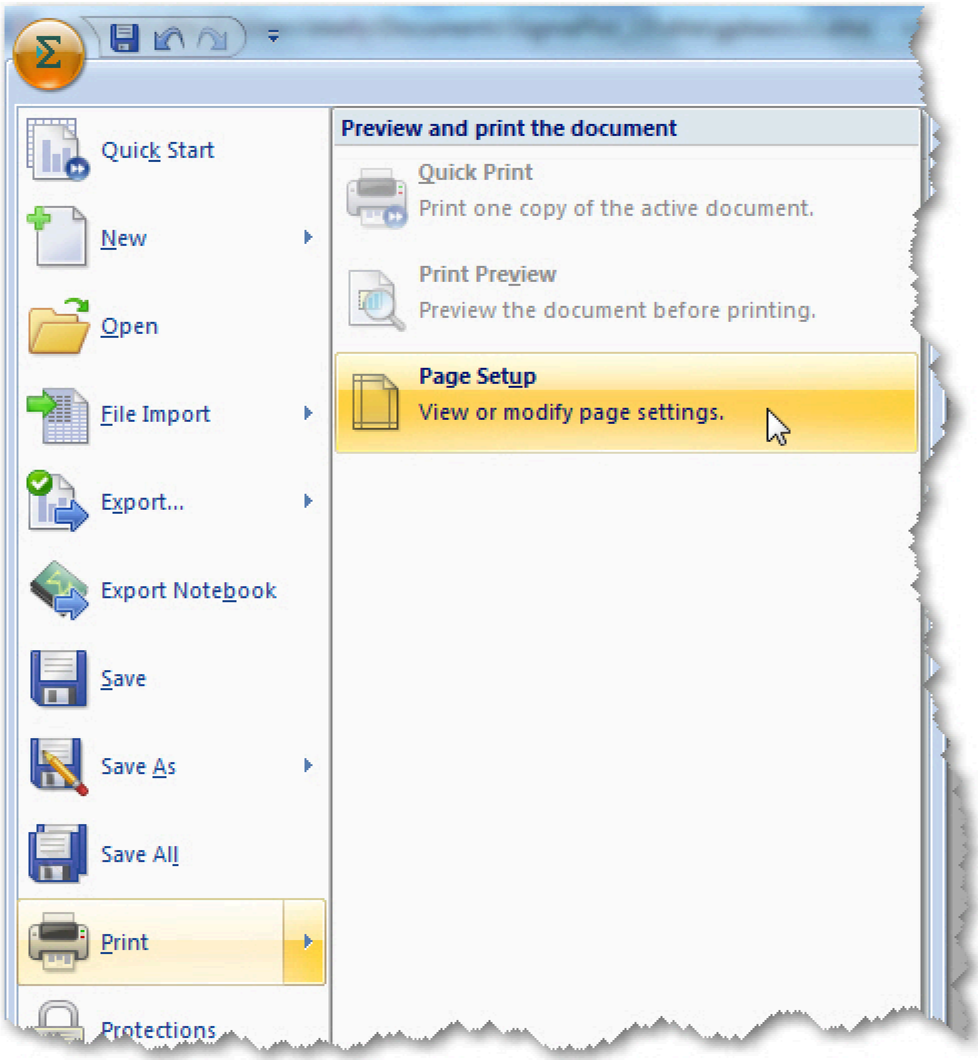
1. Make sure a graph page is in view.
2. Click the **Main Button** and then click **Print** and then click **Page Setup**.



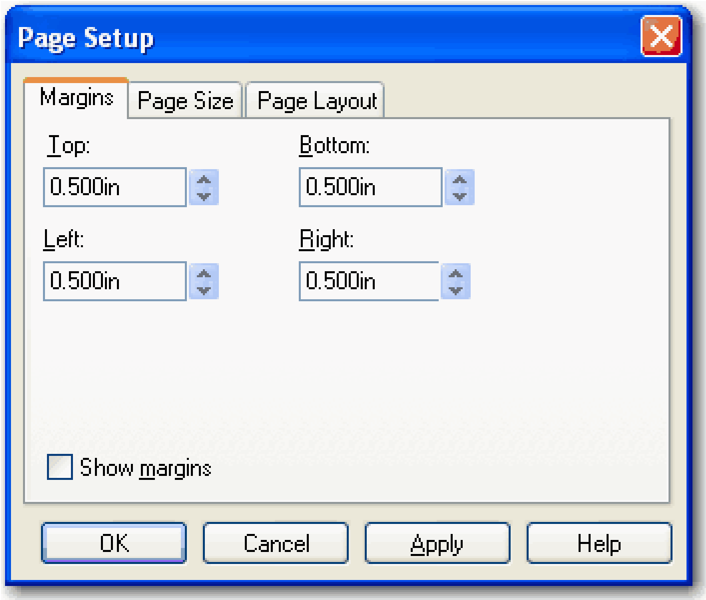
Changing and Displaying Graph Page Margins

To change page margins, and to view or hide margins on the current page:

1. Make sure a graph page is in view.
2. Click the **Main Button** and then click **Print** and then click **Page Setup**.



3. Click the **Margins** tab.



4. Use the **Top**, **Bottom**, **Left**, and **Right** options to specify the width or height of the corresponding page margin. You can type values in the edit boxes using any of the available units of measurement; the value is converted to the current measurement units specified in the **Options** dialog box. Type `in` for inches, `mm` for millimeters, and `pts` for points.

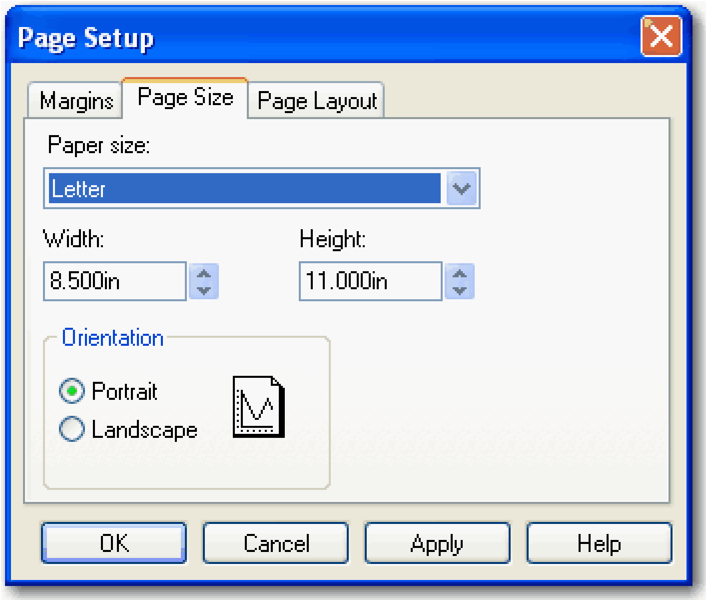
> **Note:**
> Margins do not affect printing, they are only a guide. The **Align** dialog box uses margins when aligning the page.

5. Clear or check the **Show Margins** option by selecting it. If this option is checked, margins are displayed on the page. To hide page margins, clear **Show Margins**.
6. Click **OK**.

Graph Page Size and Orientation

To change the size or orientation of the graph page:

1. Click the **Main Button** and then click **Print** and then click **Page Setup**.
2. Click the **Page Size** tab.



3. From the **Paper Size** drop-down list choose the appropriate size for the page, or select unique page sizes from the **Width** and **Height** drop-down lists.

Restriction:
SigmaPlot does not support heights or widths greater than 32 inches.

4. **To switch between portrait (normal) and landscape (sideways) orientation,** select either the **Portrait** or **Landscape** option.
5. Click **OK** to accept your changes and close the dialog box.

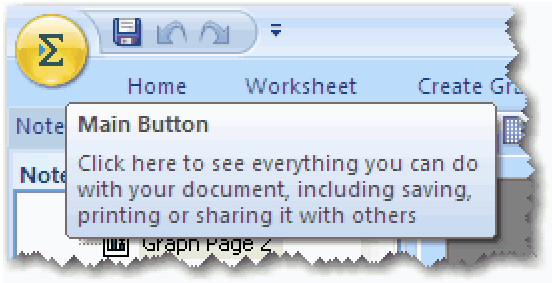
Attention:
If you change the page size or orientation, the page changes on the screen, but your graphs remain in the same relative position. You may have to move the graphs back into position.

Changing Page Units of Measurement

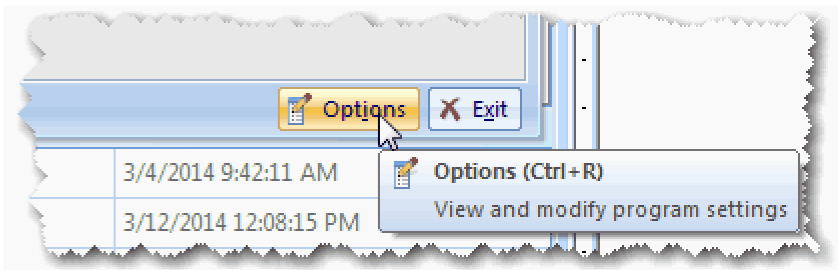
Use the **Page Options** dialog box to change the units of measurement used on a graph page. Page units of measurement are important when specifying margins and object size and position. These settings apply to all pages and graph and object properties dialog boxes.

To change the unit of measurement used:

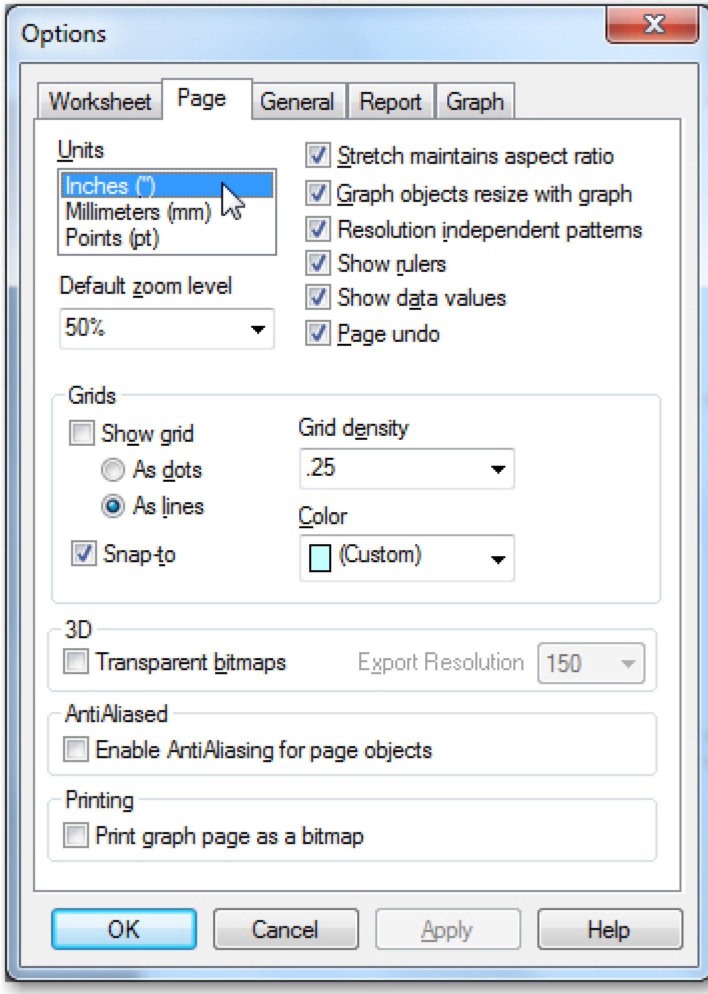
1. Click the .



2. Click **Options**.



3. Click the **Page** tab.



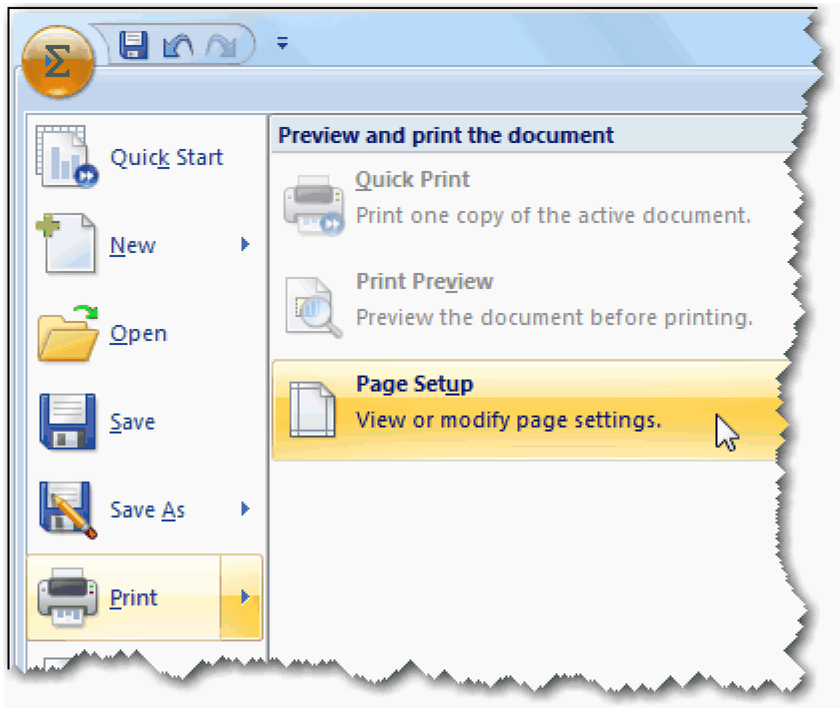
4. From the **Units** box, select the unit of measurement to use on the page. You can choose to use inches, millimeters, or points.
5. Click **OK** to accept the changes and close the dialog box.

Changing Page Color

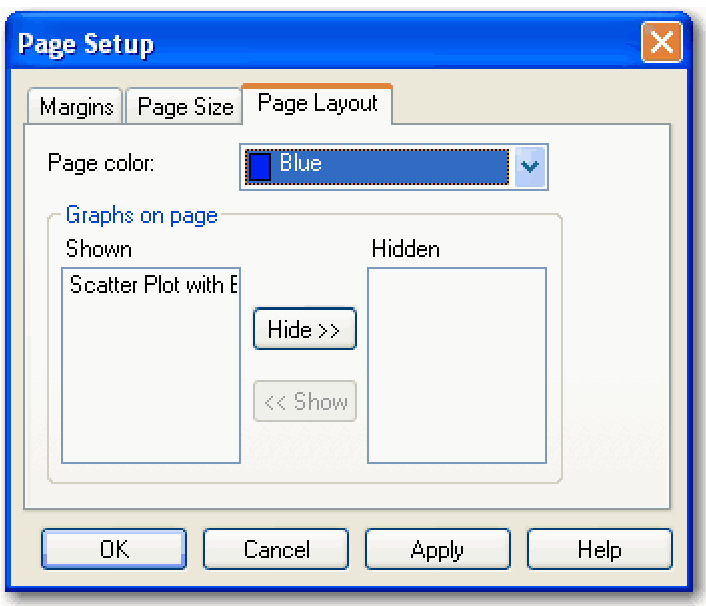
You can change the color of a page using the Page Setup dialog box. This is especially useful when creating output for slides or for overhead projectors.

To change the color of a page:

1. Make the page active by selecting it.
2. Click the **Main Button**, click **Print**, and then click **Page Setup**.



3. Click the **Page Layout** tab.



4. From the **Color** drop-down list, select the color to use for the page. Select **(Custom)** to use or create a custom color. For more information, see Using Custom Colors and Incrementing Schemes *(on page 199)*.

5. Click **OK**.

> **Tip:**
> If you want no background color to show up for pasted graphs (for example, pasting a graph into PowerPoint), set the page color to **None**.

Page Color Default Setting

You can set the default color for a new page by opening the template file and change the attributes for the Normal page using the **Page Setup** dialog box for that page.

If there is no template file or Normal page present, page settings are derived from the settings stored in the **spw.ini** file.

For more information, see About SigmaPlot's User and Program Files *(on page 21)*.

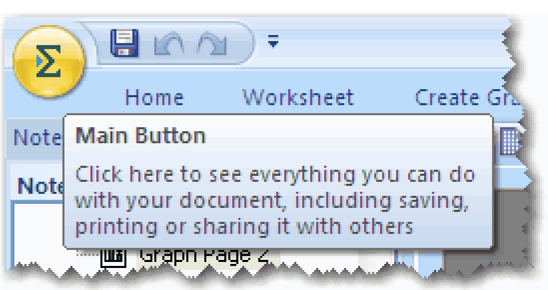
Templates

You can overwrite the current page entirely by applying a template to it. This is not recommended as a means of reformatting the page unless you intend to discard all changes made to the page up to this point. For more information, see Using Templates *(on page 155)*.

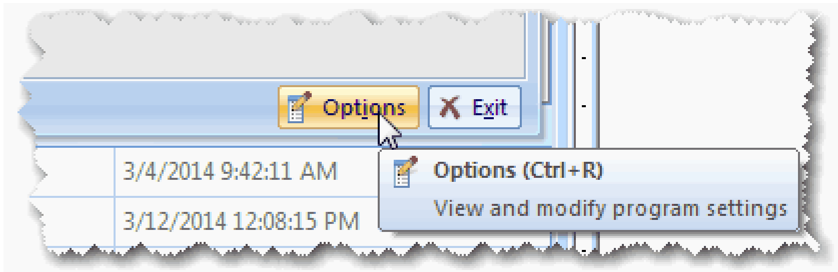
Enabling Antialiased Lines on a Graph Page

Antialiasing is a technique used by computer graphic software to smooth out jagged, stair step lines. In SigmaPlot, you control this in the **Options** dialog box.

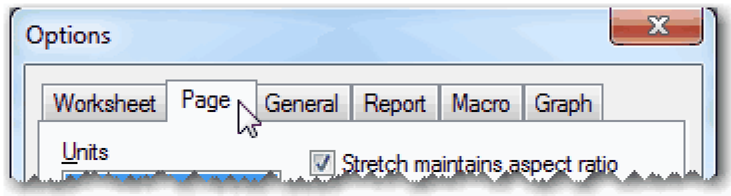
1. Click the **Main Button**.



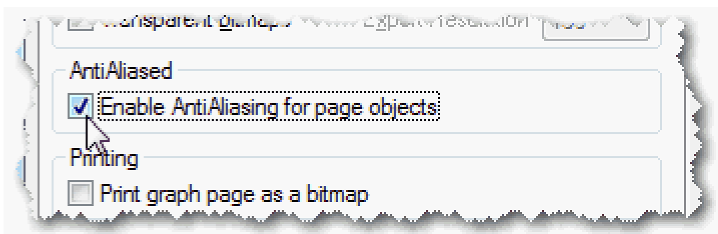
2. Click **Options**.



3. In the **Options** dialog box, click the **Page** tab.



4. Under **AntiAliasing**, select **Enable AntiAliasing for page objects**.



Using Custom Colors and Incrementing Schemes

Color drop-down lists have a **(Custom)** option that opens the **Color** dialog box, from which you can select a custom color from over 16.7 million possible combinations of red, green, and blue (24-bit color).

Chapter 5. Worksheet Basics

Worksheets are the containers for the data you analyze and graph.

They are spreadsheet-like in appearance but are limited in function, and are column rather than cell oriented.

To enter data, you can type in, paste, or import data from other sources. You can also automatically generate and place data in worksheet columns by data transforms and statistical procedures.

Opening Worksheets

You can open as many worksheets as you like in a single notebook file. Each worksheet you open is assigned to its own notebook section.

To open a worksheet:

1. Right-click the notebook file in which you would like the new worksheet to appear.
2. In the shortcut menu click **New** and then click **Worksheet**.

Saving Worksheets to Notebooks

Worksheets are saved along with the other contents of notebook files, including graph pages, reports, and so on.

1. To save data for the current worksheet to a notebook file:

    a. Right-click the worksheet in the **Notebook Manager**, and then click **Save**.
    If you are saving the notebook for the first time, the **Save As** dialog box appears prompting you for a file name and path for the notebook file. If you are saving the worksheet to an existing notebook file, the notebook is updated to include the new worksheet or the changes to the existing worksheet.

2. To export a worksheet as a different file type (non-notebook file):
    a. Select **File > Export > Worksheet**
    b. With the worksheet in view, click the **Home** tab.
    c. In the **Export** group, click **Worksheet**.

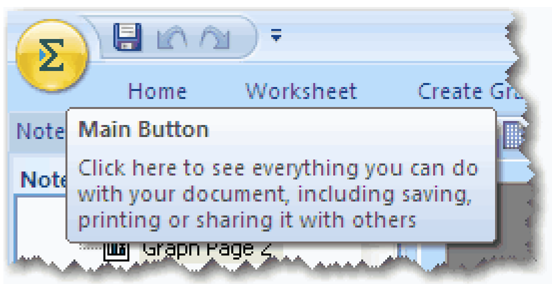
Setting Worksheet Display Options

Use the **Options** dialog box to set the default display settings for worksheets.

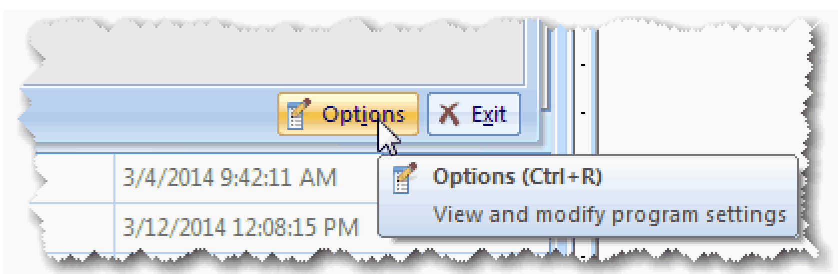
> **Tip:**
> You can also change individual cells or blocks of cells using the **Format Cells** dialog box. These custom formats remain even after editing options in the Options dialog box.

To set worksheet display options:

1. Click the **Main Button**.

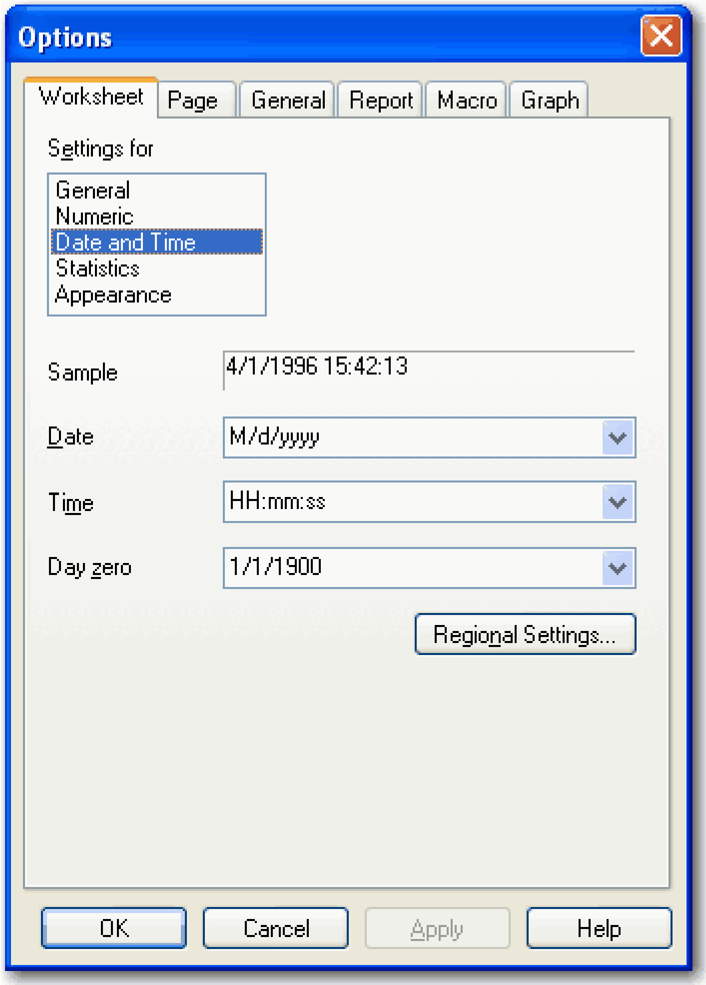


2. Click **Options**.



3. In the **Options** dialog box, click the **Worksheet** tab. For more information, see Displaying Worksheet Data *(on page 211)*.

Figure 34. The Options Dialog Box Worksheet Tab Data and Time Options



Options on the **Worksheet** tab include:

- **General.** Select to turn **Worksheet undo** on or off, or to set SigmaPlot to display an error message if duplicate column titles appear when running transforms. Turn **Worksheet undo** off if you are using a large data set and have a small amount of memory.
- **Numeric.** Select to control how many decimal places you want to appear in the worksheet, or if you want to use E notation. For more information, see Displaying Worksheet Data *(on page 211)*.
- **Date and Time.** Select to set the display for the specified columns. For more information, see Displaying Worksheet Data *(on page 211)*.

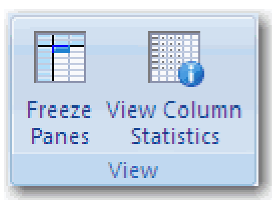
- **Statistics.** Use the **Show** and **Hide** buttons to move the statistics between the **Shown** and **Not Shown** lists. These buttons are available only if a Statistics worksheet is in focus. For more information, see Descriptive Statistics for Worksheets *(on page 207)*.
- **Appearance.** Set column widths, row heights, color and thickness of the worksheet grid lines, adjust data feedback colors, and select a font style and size. For more information, see Displaying Worksheet Data *(on page 211)*.

Freezing Panes

You can *freeze panes* to keep rows and columns visible as you scroll through the worksheet.

To freeze panes:

1. Select a cell below and to the right of where you want the split to appear.
2. On the **Worksheet** tab, in the **View** group, click **Freeze Panes**.



Moving Around the Worksheet

You can move around the worksheet using scroll bars or, move the highlighted worksheet cursor with the keyboard.

- ⇢ **or** ⇠. Move one column right/left
- ⇡ **or** ⇣. Move one row up/down
- **Page Up or Page Down.** Move one window view up/down
- **End.** Move to end of column
- **End+End or Ctrl+End.** Move to end of worksheet
- **Home.** Move to top of column
- **Home+Home or Ctrl+Home.** Move to column one, row one
- **Ctrl + →.** Move to last column of next data block
- **Ctrl + ←.** Move to first column of previous data block
- **Ctrl + ↑.** Move to top row of previous data block

- **Ctrl + ↓.** Move to last row of last data block
- **F2.** Put cells into Edit mode.

Going to a Cell

You can move the worksheet cursor to any cell in the worksheet by specifying the column and row number in the Go to Cell dialog box.

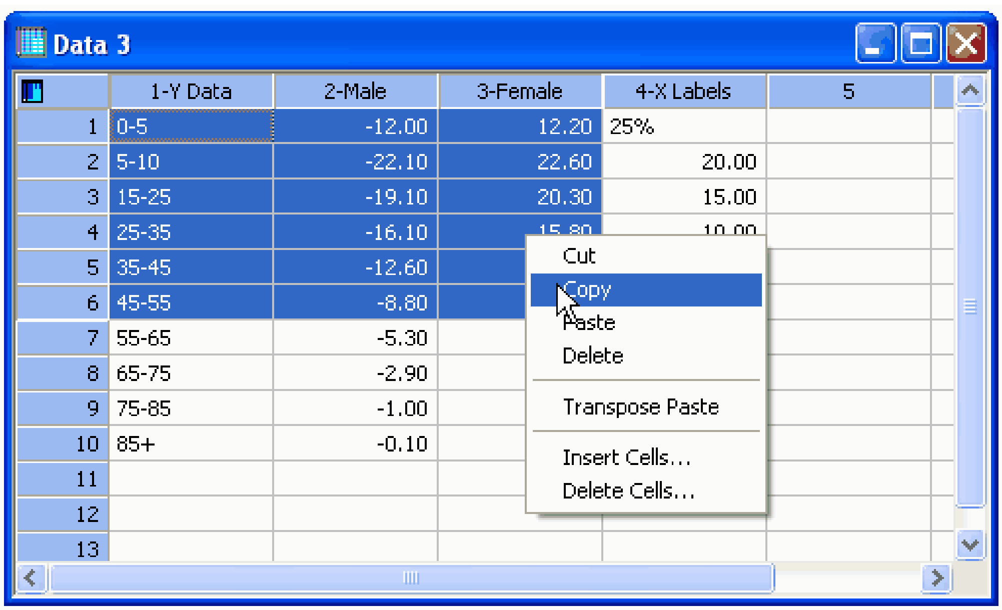
To go to a cell:

1. Select **Worksheet > Edit > > Go To**
2. In the **Go to Cell** dialog box, enter the desired column and row number.
3. **To select the block of cells between the current highlight location and the new cell,** click **Extend Selection to Cell**.
4. Click **OK** to move to the new cell.

Using the Worksheet Shortcut Menu

In addition to the commands available in SigmaPlot ribbons, right-clicking the worksheet displays a shortcut menu. The commands on the right-click shortcut menu include the **Cut**, **Copy**, **Paste**, **Transpose Paste**, **Insert Cells** and **Delete Cells** commands.

Figure 35. Right-click Edit Worksheet Menu



Entering Data into a Worksheet

This section describes entering data into worksheet columns, and formatting the columns for numeric, label, or date and time display.

To enter data into a SigmaPlot worksheet:

1. Place the cursor in a cell.
2. Type a number, label, or date and time value.
3. Press **Enter** to move down one row, or use the arrow keys to move around the worksheet.

Importing Files from Other Applications

You can import data from other applications into an existing worksheet for graphing, worksheet display, or running regressions. When you import data, it appears at the position of the worksheet cursor.

- Excel 2007 files (.xlsx)
- SAS Data Set (V6) (*.sd2)
- SAS Data Set (V8 and V9) (*.sas7bdat)
- SAS Export File (*.xpt)
- Minitab (v8 to v12) (*.mtw, *mpj)

You can import the following file types into SigmaPlot worksheets:

- SPSS (.sav).
- Lotus 1-2-3 files (.wks, .wk*).
- Quattro/DOS files (.wq1*).
- Text files (.txt, .prn, .dat, .asc).
- Comma Delimited files (.csv)
- Symphony (.wkl, .wri, .wrk, .wks)
- SYSTAT (.sys, .syd)

When you import data from another application that is left-justified, SigmaPlot assumes it is text.

To import data:

1. Place the cursor to the worksheet cell where you want the imported data to start.
2. On the **Worksheet** tab, in the **Import** group, click .

3. In the **Import File** dialog box, select the type of file you want to import from the **Files of Type** drop-down list.
4. Change the drive and directory as desired, select the file you want to read, then click **Import**, or double-click the file name. Depending on the type of file, the data is either imported immediately, or another dialog box appears.

Copying and Pasting Data from Other Applications

Perhaps the easiest way to import data from another application is to simply copy and paste it from that application's spreadsheet into SigmaPlot. This is perhaps the simplest method, especially if you cannot directly import the data into SigmaPlot. For more information, see Moving Data *(on page 231)*.

Once you have copied and pasted the data, you can promote the top row of data - the variable names - to become the column titles.

Importing ODBC Databases

You can import ODBC compliant databases into SigmaPlot. To import a database, first define an *ODBC Data Source*. After defining the data source, you can then either import tables or import using *SQL* (structured query language).

Note:
For more information on SQL, see the many sources and tutorials available on the Internet.

To define the ODBC data source:

On the **Worksheet** tab, in the **Import** group, click .

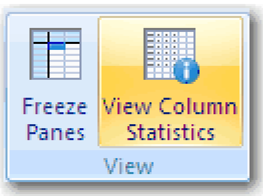
Importing Excel as ODBC

When importing Excel spreadsheets using the **ODBC Options** dialog box, you must first assign a name to each data set (or a range of data) which is then imported as a table; otherwise, the Excel file will not import.

Descriptive Statistics for Worksheets

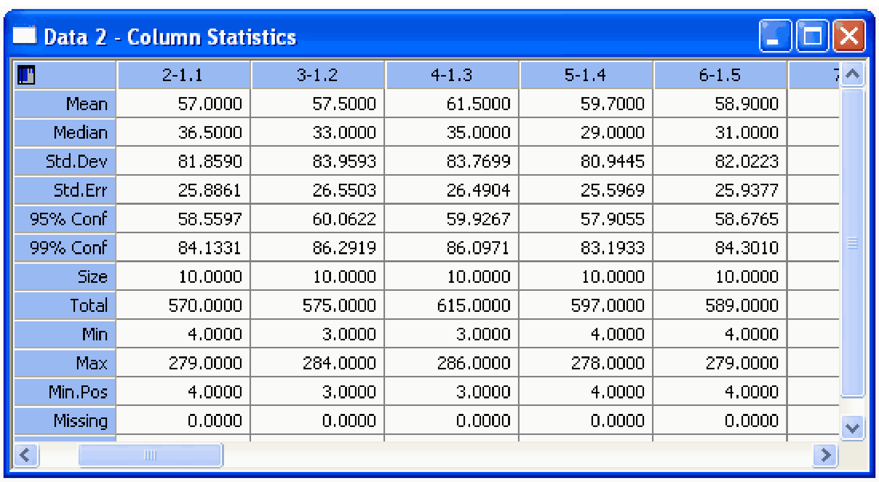
SigmaPlot automatically calculates a number of basic statistical values for all the data in your worksheet columns. For more information, see Printing the Current Worksheet *(on page 243)*.

To view the statistics for the currently selected worksheet, on the **Worksheet** tab, in the **View** tab, click **View Column Statistics**.



The running calculations performed for each column appear in a Column Statistics window for that worksheet.

Figure 36. Column Statistics Worksheet



Data 2 - Column Statistics

	2-1.1	3-1.2	4-1.3	5-1.4	6-1.5
Mean	57.0000	57.5000	61.5000	59.7000	58.9000
Median	36.5000	33.0000	35.0000	29.0000	31.0000
Std.Dev	81.8590	83.9593	83.7699	80.9445	82.0223
Std.Err	25.8861	26.5503	26.4904	25.5969	25.9377
95% Conf	58.5597	60.0622	59.9267	57.9055	58.6765
99% Conf	84.1331	86.2919	86.0971	83.1933	84.3010
Size	10.0000	10.0000	10.0000	10.0000	10.0000
Total	570.0000	575.0000	615.0000	597.0000	589.0000
Min	4.0000	3.0000	3.0000	4.0000	4.0000
Max	279.0000	284.0000	286.0000	278.0000	279.0000
Min.Pos	4.0000	3.0000	3.0000	4.0000	4.0000
Missing	0.0000	0.0000	0.0000	0.0000	0.0000

Available Statistics

To determine the statistics shown in the **Statistics** windows, use the Statistics Options dialog box. Most calculations ignore empty cells, missing values, and text. The following statistics appear in the **Column Statistics** window.

Mean. The arithmetic mean, or average, of all the cells in the column, excluding the missing values.

This is defined by $X = \frac{1}{N}\sum_{-}^{i} x_i$

Std Dev. The sample standard deviation is defined as the square root of the mean of the square of the differences from their mean of the data samples xi in the column. Missing values are ignored.

$$s=\left[\frac{1}{n-1}\sum_{i}\left(x_1-\bar{x}\right)^2\right]^{\frac{1}{2}}$$

Std Err. The standard error is the standard deviation of the mean. It is the sample standard deviation divided by the square root of the number of samples. For sample standard deviations

$$StdErr=\frac{s}{\sqrt{\ }}$$

95% Conf. The value for a 95% confidence interval. The end points of the interval are given by:

$$x\pm t(v,z)\frac{s}{\sqrt{n}}$$

where *x* is the mean, *s* is the sample standard deviation, and *t*(*v*,*z*) is the *t* statistic for *v*= *n-1* degrees of freedom and *z* = 1.96 standard normal percentile equivalent.

99% Conf. The value for a 99% confidence interval. The end points for this interval are computed from the equation for the 95% confidence interval using *z* = 2.576.

Size. The number of occupied cells in the column, whether they are occupied by data, text, or missing values.

Sum. The arithmetic sum of the data values in the column.

Min. The value of the numerically smallest data value in the column, ignoring missing values.

Max. The value of the numerically largest data value in the column.

Min Pos. The smallest positive value.

Missing. The number of cells in the column occupied by missing values, denoted with a double dash symbol (--).

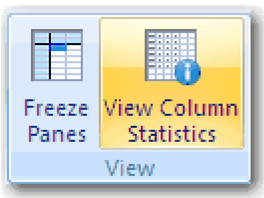
Other. Either text or an empty cell.

Statistics Options

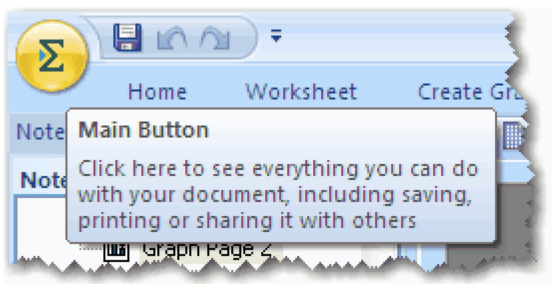
To display only a portion of the available statistics, use the Worksheet Options dialog box, then select the column statistics to show or hide. For more information, see Displaying Worksheet Data *(on page 211)*.

To specify which statistics are shown or hidden:

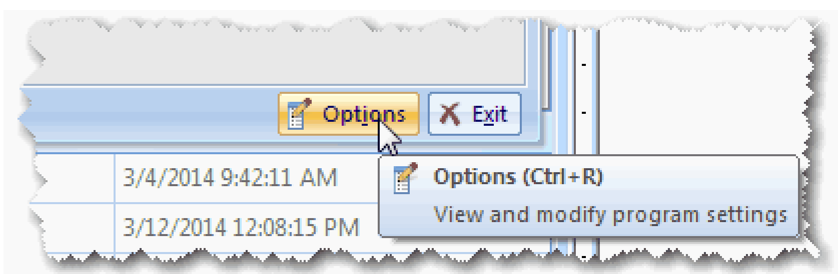
1. On the **Worksheet** tab, in the **View** group, click **View Column Statistics**.



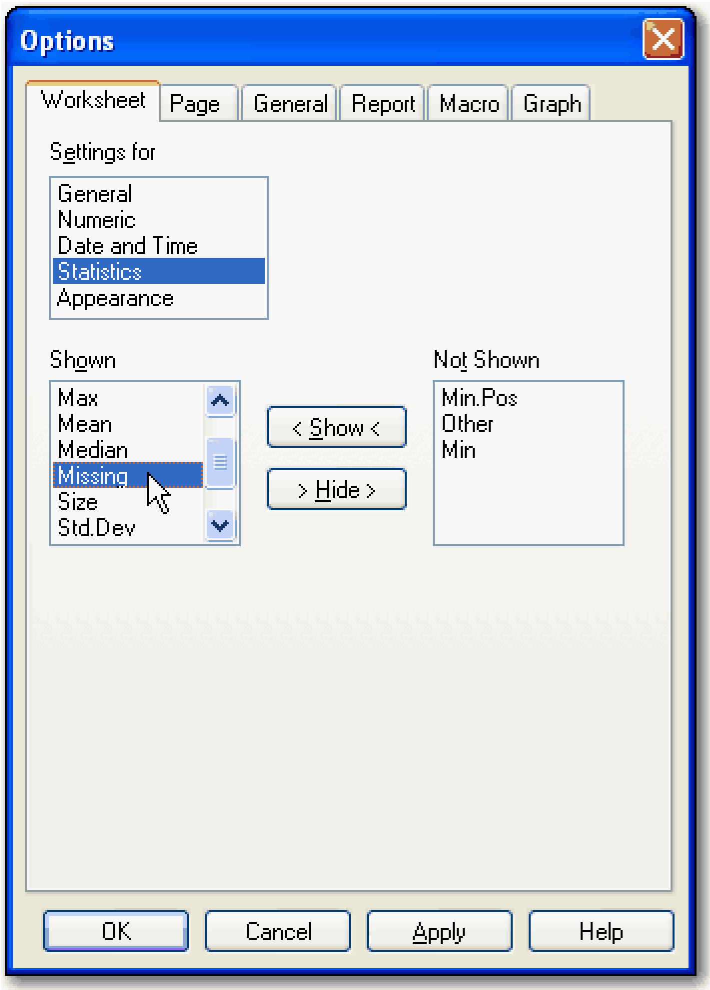
2. Click the **Main Button**.



3. Click **Options**.



4. In the **Options** dialog box, click the **Worksheet** tab.



5. Select the statistic(s) you want shown or hidden.
6. Select the appropriate options to change the column widths and data display.

Engineering and E Notation

In SigmaPlot, *E Notation* is synonymous with *scientific notation*. The *E* expresses the power of 10.

For example, 1.23 e+03 is 1230, or, equivalently, 1.23 e+03. Select **E Notation When Needed** or **E Notation Always** on the **Worksheet** tab of the **Options** dialog box if you want to use Scientific Notation.

Engineering Notation, which you can select as an option on the **Worksheet** tab of the **Options** dialog box, uses integral powers of 3 (with 10 as the base).

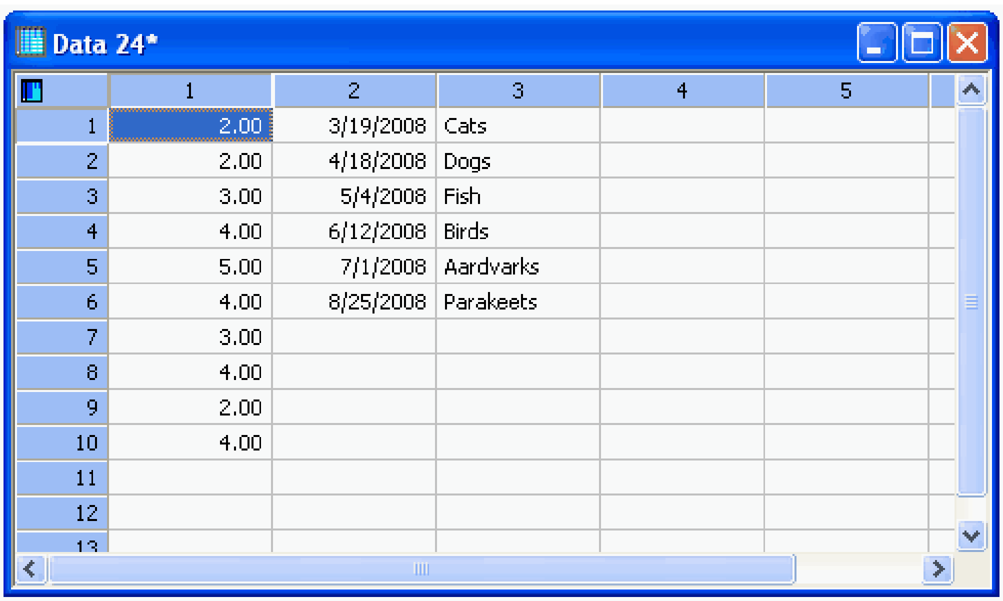
Number	Scientific Notation	Engineering Notation	Engineering Notation (SigmaPlot)

1230	1.23 e+03	1.23 e+03	1.23 x 10^3
12300	1.23 e+04	12.3 e+03	12.3 x 10^3
123000	1.23 e+05	123 e+03 or 0.123 e +06	123 x 10^3 or 0.123 x 10^6

Displaying Worksheet Data

You can display data in your worksheet columns as:

- Text
- Numbers
- Graphic information



	1	2	3	4	5
1	2.00	3/19/2008	Cats		
2	2.00	4/18/2008	Dogs		
3	3.00	5/4/2008	Fish		
4	4.00	6/12/2008	Birds		
5	5.00	7/1/2008	Aardvarks		
6	4.00	8/25/2008	Parakeets		
7	3.00				
8	4.00				
9	2.00				
10	4.00				
11					
12					

You can enter numbers, labels, and dates and times directly into the worksheet. You can also convert numbers to dates and times and vice versa. You can change column widths, number decimal places, or date and time format, and you can also change the color and thickness of the worksheet gridlines, and adjust data feedback colors.

Tip:

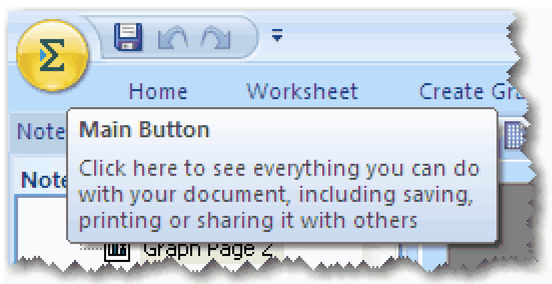
You can format columns to override the defaults set using the **Options** dialog box.

Sizing Columns and Rows

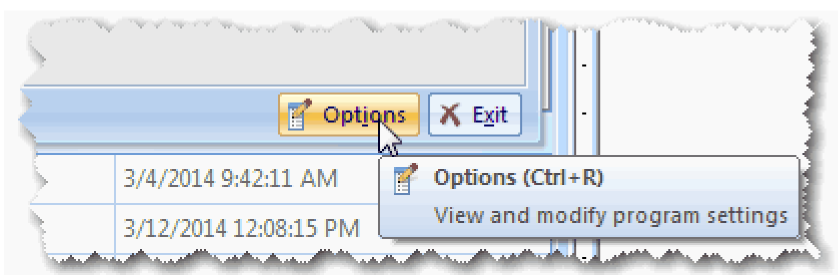
If the contents of your column exceed the column width, cell contents display as pound symbols (####). Label entries are truncated.

1. **To change a column width,** drag the boundary on the right side of the column heading until the column is the size you want.
2. **To change a row height,** drag the boundary below the row heading until the row is the size you want.
3. **To adjust column width and row height using the Options dialog box:**

   a. Click the **Main Button**.



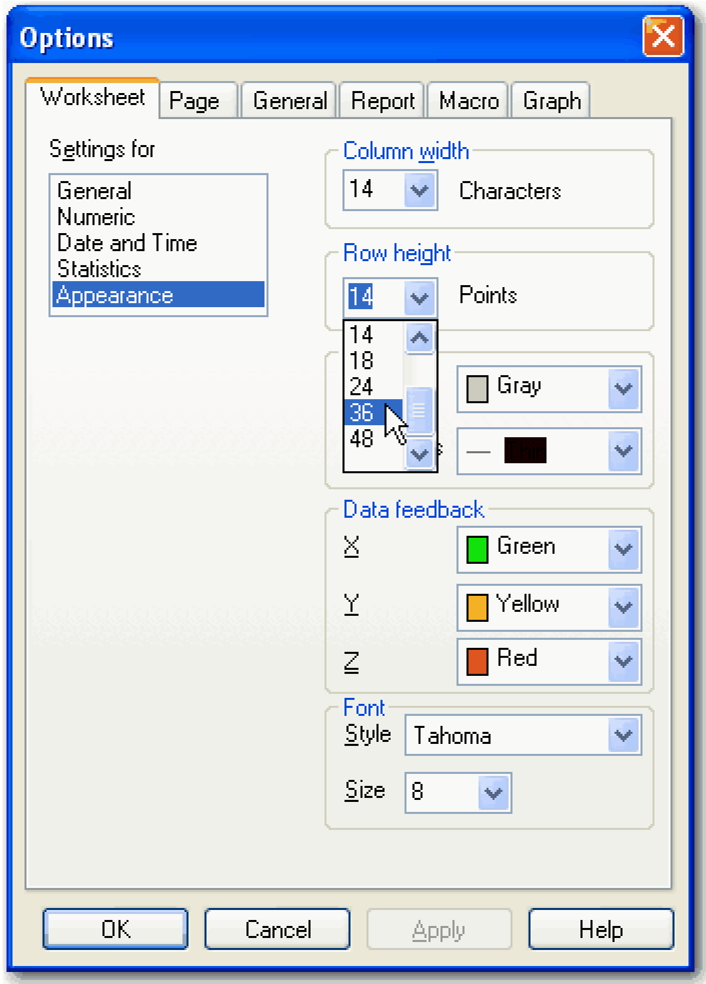
   b. Click **Options**.



   c. On the **Options** dialog box, click the **Worksheet** tab.

   d. In the **Settings For** list, click **Appearance**.

   e. Set column width and row height in the **Column Width** and **Row Height** drop-down lists.



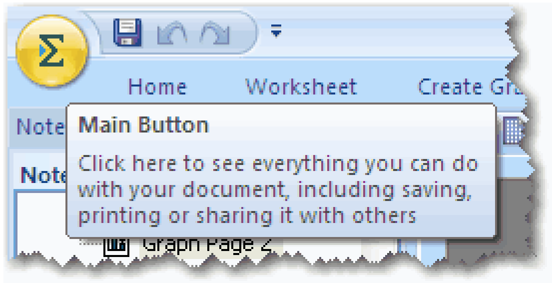
f. Click **OK** to apply the changes and close the dialog box. SigmaPlot's worksheet can display up to fourteen digits of precision regardless of how many decimal places you specify.

Changing the Appearance of the Worksheet Grid

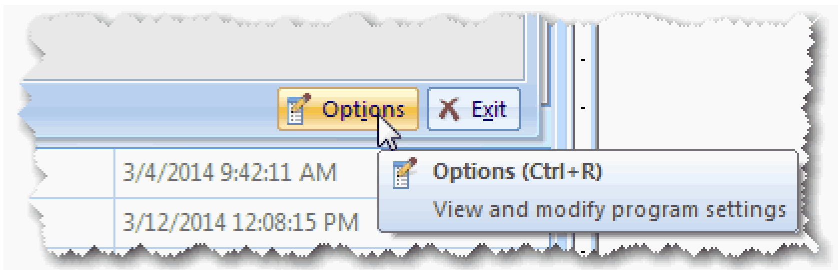
You can change the color and thickness of worksheet grid lines.

To change the grid appearance:

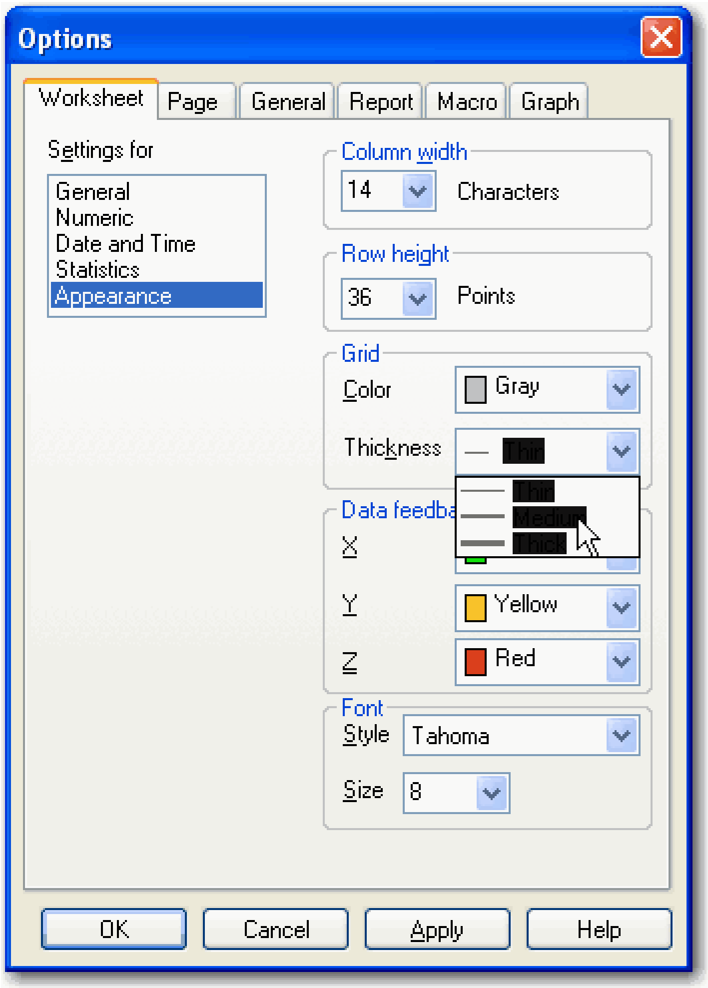
1. Click the **Main Button**.



2. Click **Options**.



3. On the **Options** dialog box, click the **Worksheet** tab.
4. In the **Settings For** list, click **Appearance**.
5. Set color and thickness in the **Color** and **Thickness** drop-down lists.



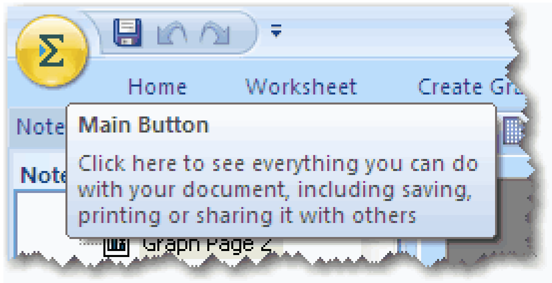
6. Click **OK** to apply the changes and close the dialog box.

Setting Data Feedback Colors

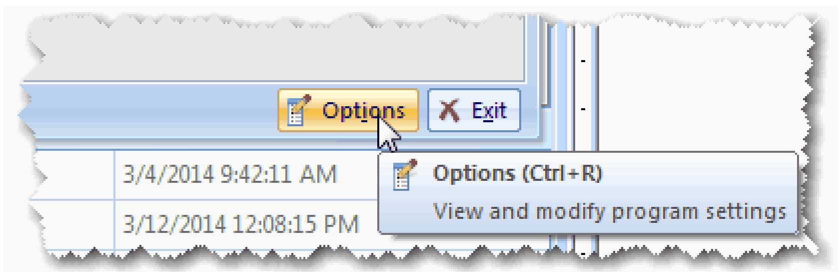
Data Feedback highlights the cells and columns on the worksheet that correspond to the X and Y values of the selected curve or data point. You can change these colors on the **Options** dialog box.

To change the data feedback colors:

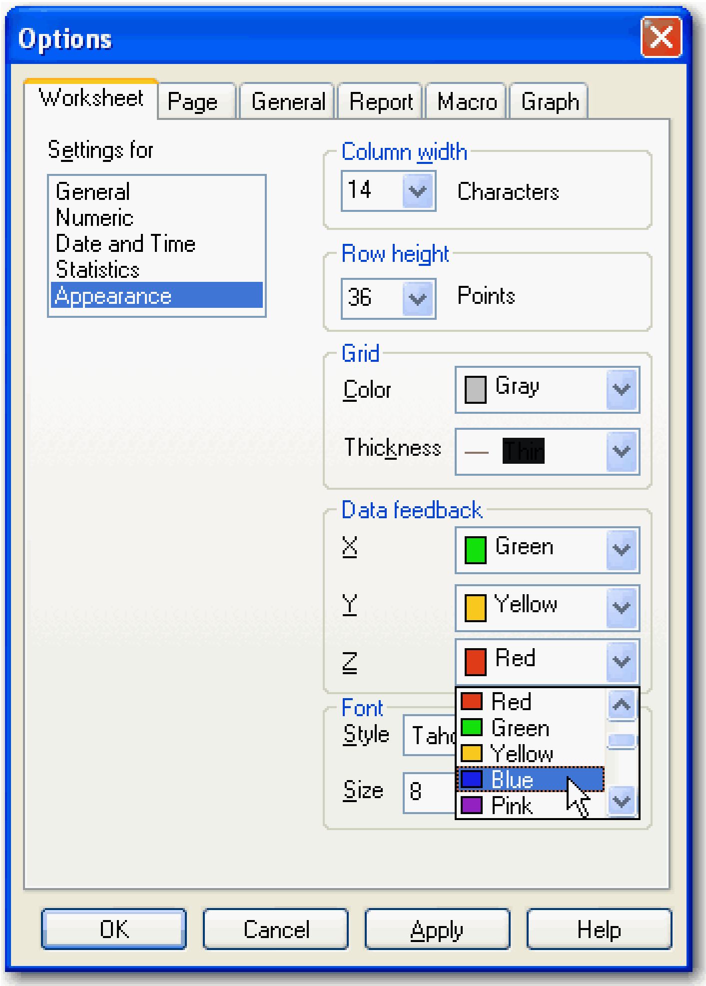
1. Click the **Main Button**.



2. Click **Options**.



3. On the **Options** dialog box, click the **Worksheet** tab.
4. In the **Settings For** list, click **Appearance**.
5. Set data feedback colors and thickness in the **X** and **Y** drop-down lists.

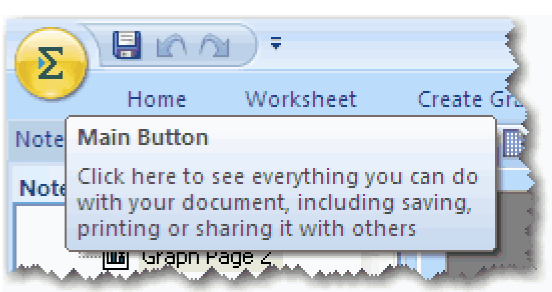


6. Click **OK** to apply the changes and close the dialog box.

Setting Decimal Places

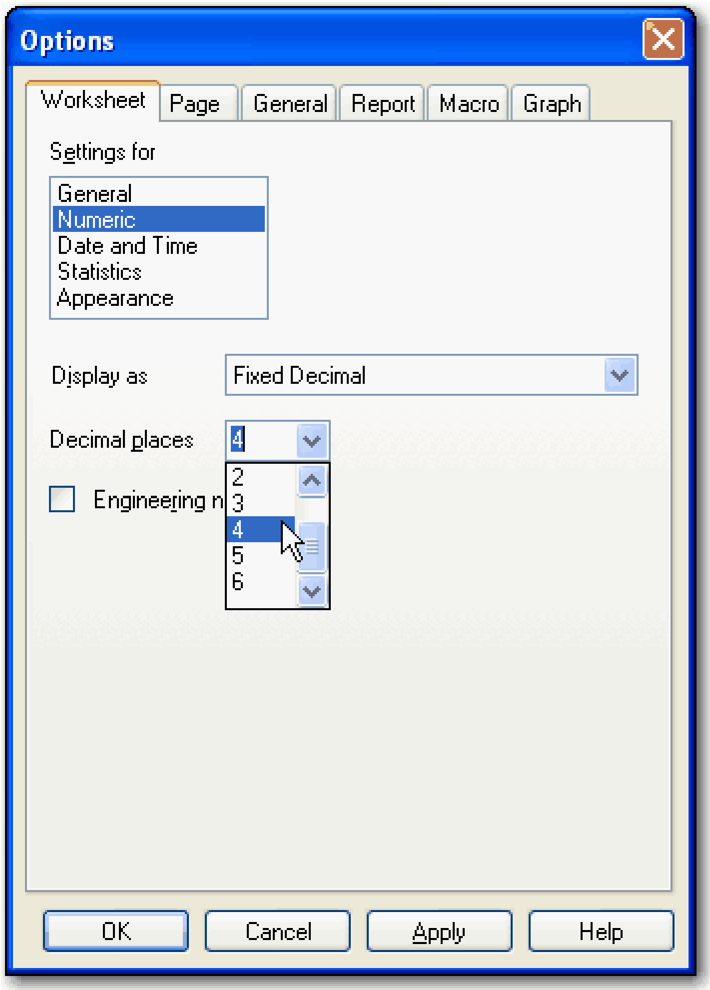
To set the number of decimal places used for worksheet values:

1. Click the **Main Button**.



2. Click **Options**.

3. In the **Options** dialog box, click the **Worksheet** tab.
4. In the **Settings For** list, click **Numeric**.
5. Select the number of decimal places from the **Decimal Places** drop-down list.



6. Click **OK** to accept the changes and close the dialog box. If the number of decimal places exceeds the column width they appear as # symbols.

Changing Numbers Display

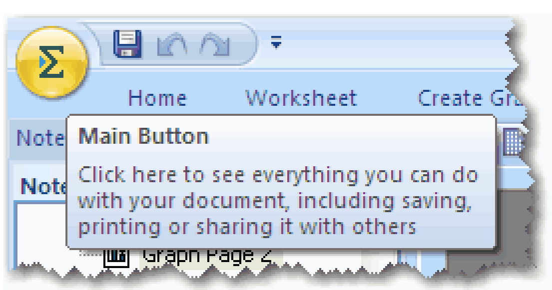
You can display numbers in the worksheet in four ways:

Numeric Display	Description	Example
E Notation When Needed	Displays worksheet data as scientific notation only when the	12.00

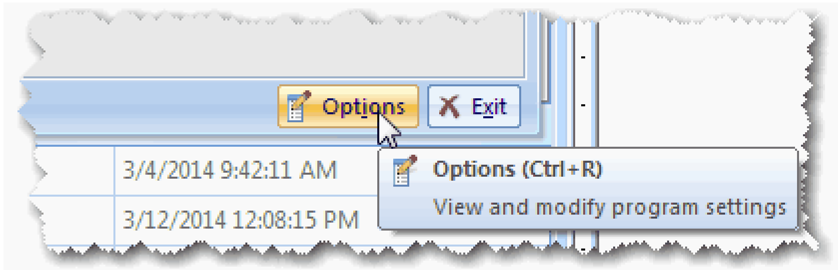
Numeric Display	Description	Example
	length of the value exceeds the width of the cell. The default column width is twelve.	
E Notation Always	Always displays data as scientific notation. The number of decimal places is set in the Decimal Places edit box.	12.00e+1
Fixed Decimal	Displays data with a fixed number of decimal places. Set the number of decimal places in the Decimal Places edit box. The number of decimal places allowed is limited by the column width – the maximum number of decimal places cannot exceed the column width or it appears as a series of # symbols. The default setting for decimal places is two.	12.00
General	Displays data exactly as you enter it in the worksheet.	12

To set the numeric display for your worksheet:

1. View the worksheet.
2. Click the **Main Button**.

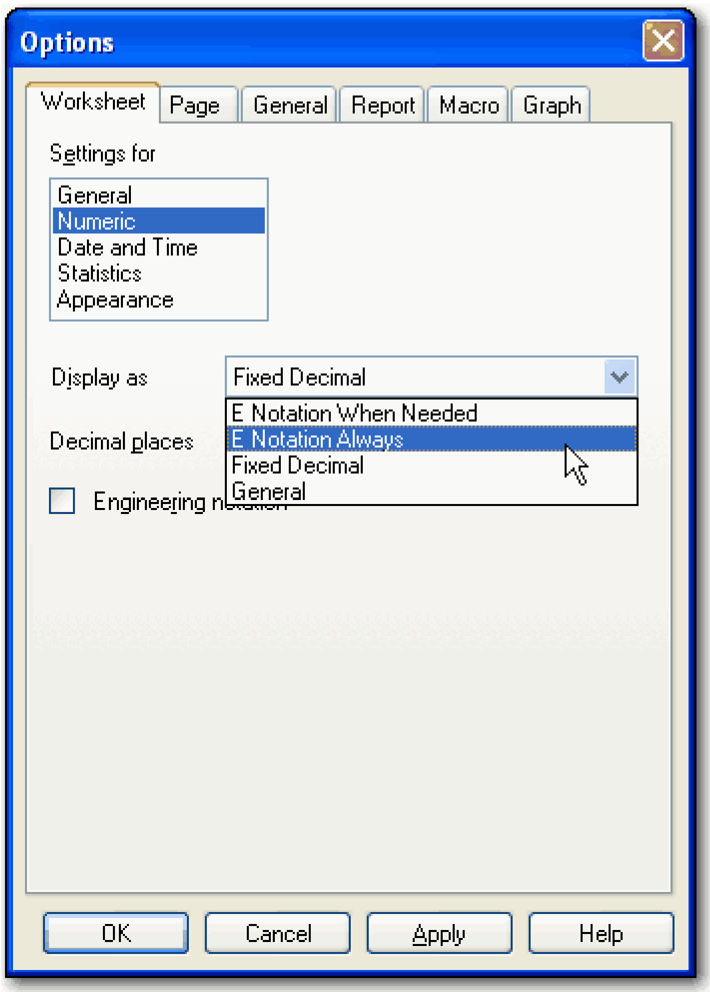


3. Click **Options**.



4. In the **Options** dialog box, click the **Worksheet** tab.
5. In the **Settings For** list, click **Numeric**.
6. Select a **Numeric** format setting from the **Display As** drop-down list.

Figure 37. Selecting Numbers Display Format



7. **To use engineering scientific notation for worksheet values,** select **Engineering Notation**. For more information, see Engineering and E Notation *(on page 210)*.
8. Click **OK** to accept the settings and close the dialog box.

Changing Date and Time Display

SigmaPlot has a variety of date/time displays. When you enter a value into a date/time formatted cell, SigmaPlot assumes internal date/time information about that value from the year to the millisecond. For example, if you enter a day and month, you can display the month and year.

To view and modify the current settings:

1. Click the .
2. Click **Options**.
3. In the **Options** dialog box, click the **Worksheet** tab.
4. Click the **Worksheet** tab.
5. Select the **Date and Time** from the **Settings for** list.

6. Type one of the following examples into the **Date** box, or select a format from the drop-down list:
    - **M/d/yyyy.** 10/8/2005
    - **M/d/yy.** 10/8/05
    - **MM/dd/yy.** 10/08/05
    - **MM/dd/yyyy.** 10/08/2005
    - **yy/MM/dd.** 05/10/08
    - **yyyy-MM-dd.** 2005-10-08
    - **MMMM.** Complete month
    - **dd-MMM-yy.** 08-Oct-05
    - **dddd, MMMM dd, yyyy.** Tuesday, October 08, 2005
    - **MMMM dd, yyyy.** October 08, 2005
    - **dddd, dd MMMM, yyyy.** Tuesday, 08 October, 2005
    - **dd-MMMM-yy.** 08-October-05
    - **dd MMMM, yyyy.** 08 October, 2005
    - **gg.** Era (AD or BC)
7. **To change the display Time format,** type one of the following examples into the **Time** box, or select a format from the drop-down list:
    - **hh or h.** 12 hour clock
    - **HH or H.** Military hours

- **mm or m.** Minutes
- **ss or s.** Seconds
- **uu or u.** Milliseconds
- **H: h: m: s: or u.** No leading zeroes for single digits
- **HH: hh: mm: ss: uu.** Leading zero for single digits
- **tt.** Double letter AM or PM
- **t.** Single letter AM or PM

8. Click **OK** to accept the settings and close the dialog box.

Setting Day Zero

SigmaPlot provides three date systems:

- 1900
- 1904
- -4713

> **Note:**
> SigmaPlot by default uses the system zero date of 4713 BC.

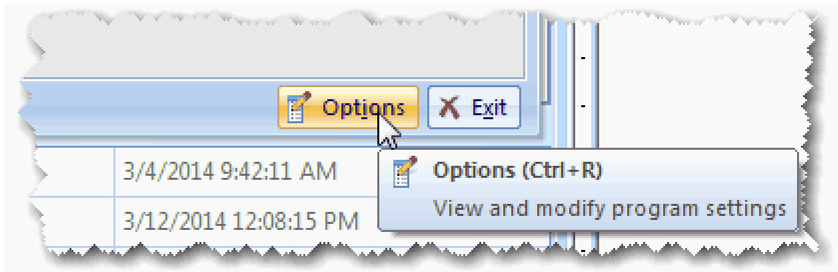
Setting a Start Date is only necessary if you are importing numbers to be converted to dates, or converting dates to numbers for export. The starting date must match the date used by the other application.

Note that SigmaPlot recognizes day zero as starting at 0. Some spreadsheet software products begin day zero at 1. This means that you may have to set your starting date in SigmaPlot to one day prior.

Also, unlike Microsoft Excel, SigmaPlot correctly treats the year 1900 as a normal year and not a leap year (a century year, to be a leap year, must be divisible by 400). If you're importing from Microsoft Excel, dates from January 1st 1900 to the day before March 1st 1900 will differ by one day.

To set the start date:

1. Click the .
2. Click **Options**.



3. In the **Options** dialog box, click the **Worksheet** tab.
4. Select a date from the **Day Zero** drop-down list, or type your own start date. The default start date is 1/1/1900.

Figure 38. The Day Zero Drop-down List

Day Zero becomes the number 01.00 when you change from Date and Time to Numbers format. The basic unit of conversion is the day; that is, whole integers correspond to days. Fractions of numbers convert to times. Zero becomes Day Zero, and negative numbers entered into the worksheet convert to days previous to the Day Zero start date.

Conversion between date/time values and numbers can occur for the calendar range of 4713 BC to beyond the year 4,000 AD. The internal calendar calculates dates using the Julian calendar until September, 1752. After that, dates are calculated using the Gregorian calendar.

Note:
If you convert numbers to dates, a start date is applied. If you convert the dates back to numbers, be sure you use the same start date as when you converted them, or they will have a different value.

Regional Settings

Drop-down lists in the **Options** dialog box worksheet tab use the current date/time settings in your operating system. The **Windows Regional Settings** control date/time delimiters, 12 or 24 hour clock, and AM/PM display.

Date and time display formats may be affected by your operating system's Regional Settings. For example, if your Time Zones are specified as British (English), your date values appear as dd/mm/yy. If the setting is US (English), your date values appear as mm/dd/yy. If you want to view or modify the current settings, or view alternative settings available on your system, click the **Regional Settings** button, or modify them directly from the **Windows Control** tab.

Note:
Date and time values appear on the worksheet using the date and time delimiters, generally a forward slash (/) or colon (:). For more information, see Entering Dates and Times *(on page)*.

Using Date/Time Format with Other Programs

You can copy date/time values from a SigmaPlot worksheet and paste them into other programs, such as an Excel workbook, or, you can copy date/time values from another program and paste them into a SigmaPlot worksheet. If the date/time format you are pasting is larger than the worksheet column width, you may need to change the column width.

If you are copying date/time values from another program to SigmaPlot, make sure that the program is displaying dates/times in a format that SigmaPlot accepts as valid data entry. For example, if you are pasting dates from Excel, make sure the dates are displayed as numbers separated by slashes (/), or whatever date delimiter Windows is set to.

To change Excel formats, see your Excel reference.
Keep the following in mind when copying or importing date and time formatted data:

- Pasted or imported numeric data does not automatically convert to Date and Time format. You must convert it using the same start date (Day Zero) that is used by the other program.
- When copying worksheet values, values are copied as numeric strings, not date/time.
- SigmaPlot recognizes Date and Time formats imported from Excel, but you will need to convert most other non-text dates and times from numbers to dates and time.

Formatting Worksheets

You can format entire columns even if they contain no data. If a populated cell in a column is already specifically formatted, as you enter data the entire column continues to use the same format, provided the data is appropriate to that format

When importing data, the import format takes precedence over the column format.

Remember:

Formatting worksheets is not the same as setting worksheet display options. Setting worksheet display options sets the *default* for the entire worksheet. You can override these defaults by *formatting* worksheet columns using the **Format Cells** dialog box.

To format worksheet columns:

1. Select an entire column.
2. On the **Worksheet** tab, in the **Cells** group, click **Format**.

3. In the **Format Cells** dialog box, click the **Data** tab.

4. Select a **Type**. The Type you select determines which Settings are available. Available Types are:
    - **Numeric.** Select **Numeric** to control how many decimal places you want to appear or if you want to use **E notation** in a selected worksheet column.
    - **Text.** Select text to wrap text using the existing column width.
    - **Date and Time.** Select **Date and Time** to set the display for the specified columns.

Tip:

If you select the Date and Time format, not only can you select a format from the **Date** and **Time** drop-down lists, you can also manually type a format into the same field.

Setting Row and Column Size

To set row and column size for a selected block of data:

1. Select a block of data on the worksheet.
2. On the **Worksheet** tab, in the **Cells** group, click **Format**.

3. In the **Format Cells** dialog box, click the **Rows and Columns** tab. The selected box reflects the selected block of rows and columns.

    Figure 39. The Format Cells Dialog Box

4. Set column width and row height from the **Column width** and **Row height** drop-down lists.
5. **To apply the row and column formats to the whole worksheet,** select **Apply to entire data region**.

6. Click **OK** to apply the changes and close the dialog box. The worksheet appears with new column and row sizes for the selected cells.

> **Note:**
> Setting row height and column width from the **Format Cells** dialog box only changes the selected block of data.

Switching Between Date and Time and Numeric Display

You can convert between date/time and numeric display when:

- Importing data.
- Switching numbers to dates.
- Modifying the display between date, time and date/time.

To display worksheet cells in Date and Time format:

1. View the worksheet.
2. Select the data you wish to display in date/time format.
3. On the **Worksheet** tab, in the **Cells** group, click **Format**.
4. In the **Format Cells** dialog box, click the **Data** tab.
5. In the **Type** list, click .
6. Click **OK**. The data is displayed showing the date, time, or date and time as specified. The dates and times that are entered as dates and times are automatically displayed as such.

Customizing Date and Time Formats

SigmaPlot comes with a long list of data formats far beyond what you see in its drop-down list in the **Format Cells** dialog box. All you need to do is type one into the field itself. A complete listing of all the available date and time formats appears below.

To change the date and time format:

1. View the worksheet.
2. Select the data you wish to display in format.
3. On the **Worksheet** tab, in the **Cells** group, click **Format**.

4. In the **Format Cells** dialog box, click the **Data** tab.

5. **To change the date format,** type any format from the following table, using any additional characters as delimiters (for example, slashes, commas, spaces, and so on. As you enter a different format, the Sample fields shows an example of the labels.

Option	Description
Typing:	**Displays:**
M/d/yy	No leading 0 for single digit month, day or year
MM/dd/yy	Leading 0 for single digit month, day or year
MMMM	Complete month
dddd	Complete day of week
yyy or yyyy	Complete year
MMM	Three-letter month
ddd	Three-letter day of week
gg	Era (AD or BC)

6. **To change the time format,** use any format from this table.

Option	Description
Typing:	**Displays:**
hh or h	12 hour clock
HH or H	24 hour clock
mm or m	Minutes
ss or s	Seconds
uu or u	Milliseconds
H:h:m:s:or u	No leading zeroes for single digits
HH:hh:mm:ss:uu	Leading zero for single digits

Option	Description
tt	Double letter AM or PM
t	Single letter AM or PM

Sorting Data

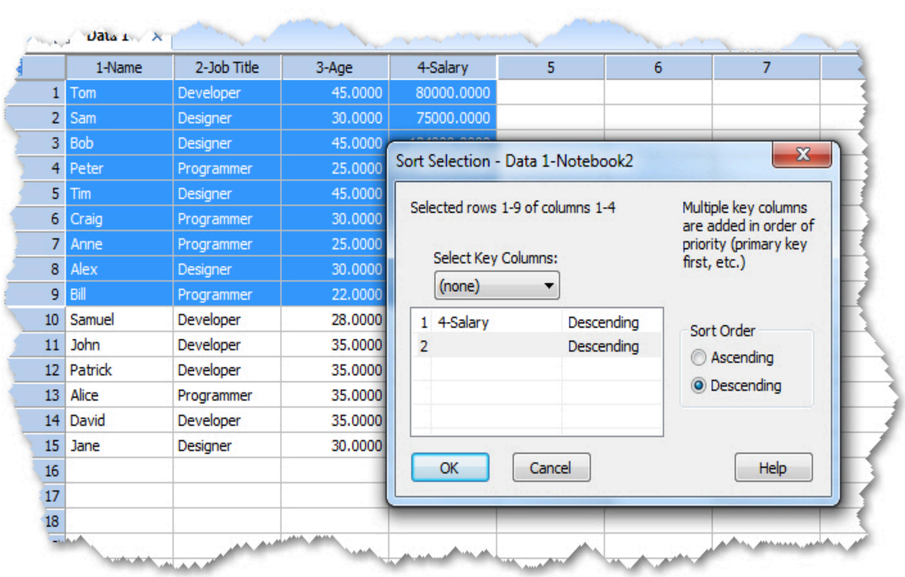
You can use SigmaPlot's built-in Sort Selection transform to move selected blocks of data in ascending or descending order according to the order in a key column. You can sort both numerically and alphabetically.

> **Tip:**
> Because the Sort command sorts data in place, if you want the original data to remain intact, copy the data to a new location and sort the copied data.

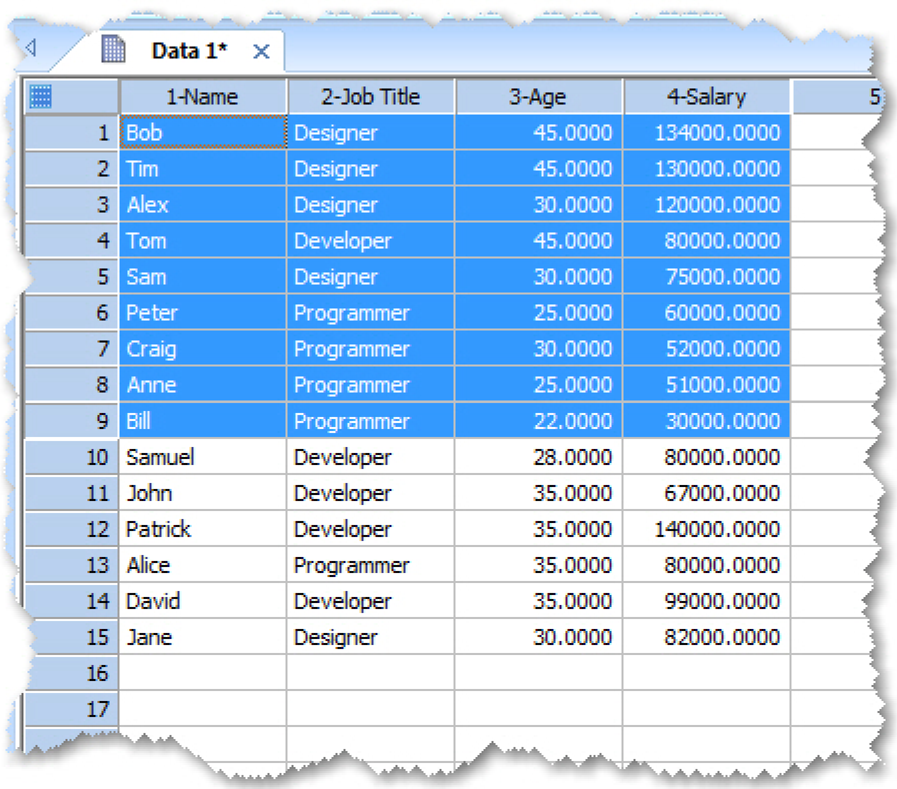
To sort selected data:

1. Use the mouse or keyboard to select the data you want to sort. Only the selected columns and rows are sorted; unselected values within a column are ignored.
2. On the **Worksheet** tab, in the **Edit** group, click **Sort**.

   The **Sort Selection** dialog box appears.



3. **To set the key column,** select its column title or column number from the **Set Key Columns** drop-down list.
4. Under **Sort Order**, select either **Ascending** or **Descending**.
5. Click **OK** to sort the data in place and close the **Sort Selection** dialog box.



Data 1*

	1-Name	2-Job Title	3-Age	4-Salary	5
1	Bob	Designer	45.0000	134000.0000	
2	Tim	Designer	45.0000	130000.0000	
3	Alex	Designer	30.0000	120000.0000	
4	Tom	Developer	45.0000	80000.0000	
5	Sam	Designer	30.0000	75000.0000	
6	Peter	Programmer	25.0000	60000.0000	
7	Craig	Programmer	30.0000	52000.0000	
8	Anne	Programmer	25.0000	51000.0000	
9	Bill	Programmer	22.0000	30000.0000	
10	Samuel	Developer	28.0000	80000.0000	
11	John	Developer	35.0000	67000.0000	
12	Patrick	Developer	35.0000	140000.0000	
13	Alice	Programmer	35.0000	80000.0000	
14	David	Developer	35.0000	99000.0000	
15	Jane	Designer	30.0000	82000.0000	
16					
17					

Stacking Columns

You can merge the contents of two or more columns by stacking the column contents on top of each other.

1. Click a worksheet in view, click the **Analysis** tab.
2. In the **Transforms** group, select **Statistical > Stack**.

   The **Pick Columns for Stacked Columns** dialog box appears.
3. Select the output column to place the stacked data by clicking the worksheet column.
4. Select the columns to stack, either by clicking the worksheet columns, or selecting the column from the **Data for Input** drop-down list.

5. Click **Finish** to stack the contents of the selected input columns in the selected output column.

> **Restriction:**
> You cannot stack blocks of data, only entire columns.

Selecting a Block of Data

There are several ways to select a block of worksheet cells. You can:

- Drag the mouse over the desired worksheet cells while pressing and holding down the left mouse button.
- Hold down the Shift key and press the arrow, PgUp, PgDn, Home, or End keys.
- Select **Worksheet > Edit > Go To**.

	1	2	3	4	5
1	2.00	2.00	4.00	4.00	
2	2.00	4.00	74.00	7.00	
3	3.00	1.00	8.00	8.00	
4	4.00	2.00	2.00	2.00	
5	5.00	2.00	1.00	1.00	
6	4.00	1.00	4.00	4.00	
7	3.00	4.00	1.00	4.00	
8	4.00	2.00	1.00	5.00	
9	2.00	4.00	1.00	2.00	
10	4.00	1.00	1.00	1.00	
11					
12					
13					

1. **To select an entire column,** move the pointer to the column title row and click.
2. **To select entire rows,** move the pointer to the row title column and click.

Cutting and Copying Data

Cut removes a selected cell or block from the worksheet and copies it to the Clipboard. Copy copies data to the Clipboard without deleting it from the worksheet.

Pasting Data

To paste data:

1. Click or move the worksheet cursor to the cell where you want to paste the data, or to the upper-left corner of the block.
2. Press Ctrl+V. Any data in the Clipboard is placed in the worksheet.

Moving Data

Move a block of data by cutting it, selecting the upper-left cell of the new location, then pasting the block. For more information, see Deleting Data *(on page 231)*.

Deleting Data

Press Delete. This operation does not copy data to the Clipboard, and is faster than cutting.

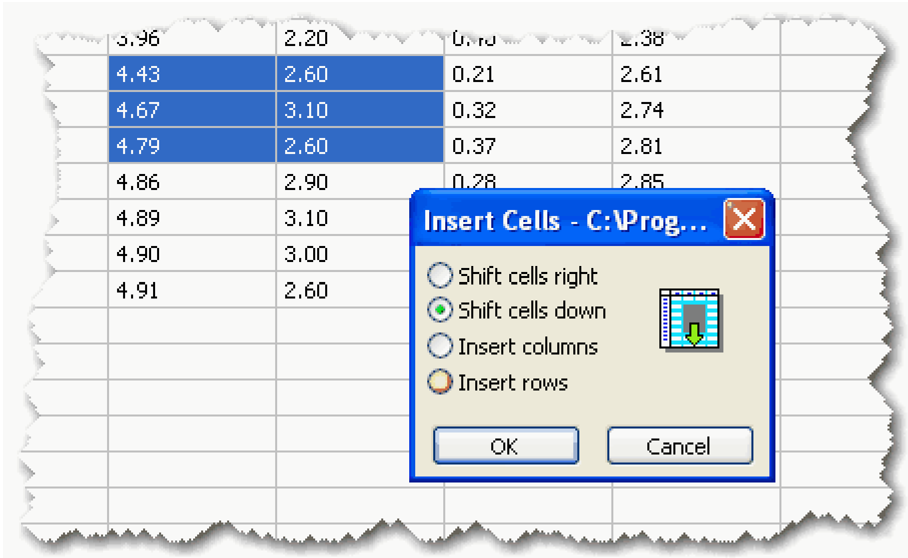
Inserting Blocks of Cells, Columns, and Rows of Data

You can insert blank blocks cells, rows, and columns into the worksheet, and fill them with data. If you're moving and copying cells, you can insert them between the existing cells to avoid pasting over data.

To insert a column, row, or blocks of cells into the worksheet:

1. Drag the mouse over the region where you want the empty block of cells, column, or row to appear. The selected region of cells indicates exactly which cells will be inserted.
2. Right-click, and then on the shortcut menu, click **Insert Cells**.

   The **Insert Cells** dialog box appears.



3. Select the direction you want the existing data to shift when the cells are inserted, or to insert an entire column or row, select **Insert Columns** or **Insert Rows**.
4. Click **OK**. The column, row, or block of cells appears on the worksheet.

Deleting Blocks of Cells, Columns, and Rows of Data

When you delete blocks of cells, columns, and rows, you are also permanently erasing the data. It will not be available on the Clipboard.

To delete columns, rows, and blocks of cells from the worksheet:

1. Drag the mouse over the block of cells, column, or row you wish to delete.
2. Press **Delete**.

Switching Rows to Columns

You can rearrange data from a row-oriented format to a column orientation, or vice versa. When you swap data, SigmaPlot pastes contents with the row and column coordinates transposed.

To swap data column and row positions:

1. Select the block of data to transpose.
2. Cut or copy the selected data.
3. Select the cell where you want to begin pasting the data.

4. Right-click, and on the shortcut menu, select **Transpose Paste**.

   The data is pasted to the worksheet with the column and row coordinates reversed.

Entering and Promoting Column and Row Titles

Column and row titles label and identify columns and rows of data. Column titles appear in the Graph and Regression Wizards when you pick columns, identify columns for legends, and can be used instead of column numbers in transforms.

To enter or edit a worksheet column or row title:

1. Double-click the title, and enter or edit the title.
2. Press **Enter** to accept the new title. The new column or row title appears along with the original column or row number.
   You must use at least one text character in every column title. If you need to use a number as column title, type a space character (by pressing the space bar) before the number.

Using the Column and Row Titles Dialog Box

Enter and edit column and row titles using the **Column and Row Titles** dialog box.

1. To enter or edit a column title:

   a. On the **Worksheet** tab, in the **Cells** dialog box, click **Titles**.

   b. In the **Column and Row Titles** dialog box, click the **Column** tab.

   c. Enter the column title in the **Title** box.

   d. **To edit an existing title,** move to that column by clicking **Next** or **Prev**, then edit the title.

   e. Click **OK** to close the **Column Titles** dialog box when you are finished editing column titles.

2. To enter or edit a row title:

   a. On the **Worksheet** tab, in the **Cells** dialog box, click **Titles**.

b. In the **Column and Row Titles** dialog box, click the **Row** tab.

c. Enter the row title in the **Title** box.

d. **To edit an existing title,** move to that row by clicking **Next** or **Prev**, then edit the title.

e. Click **OK** to close the **Column and Row Titles** dialog box when you are finished editing row titles.

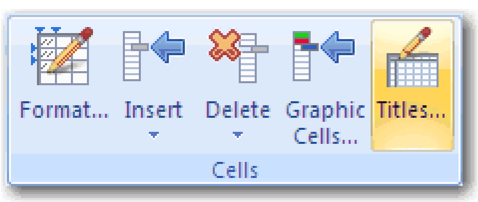
Using a Worksheet Row for Column Titles

Enter labels into a row, then use that row for worksheet column titles. This is useful for data imported or copied from spreadsheets.

All the cells of the selected row are promoted, not just those cells which contain column titles. This may effect other data sets in the worksheet.

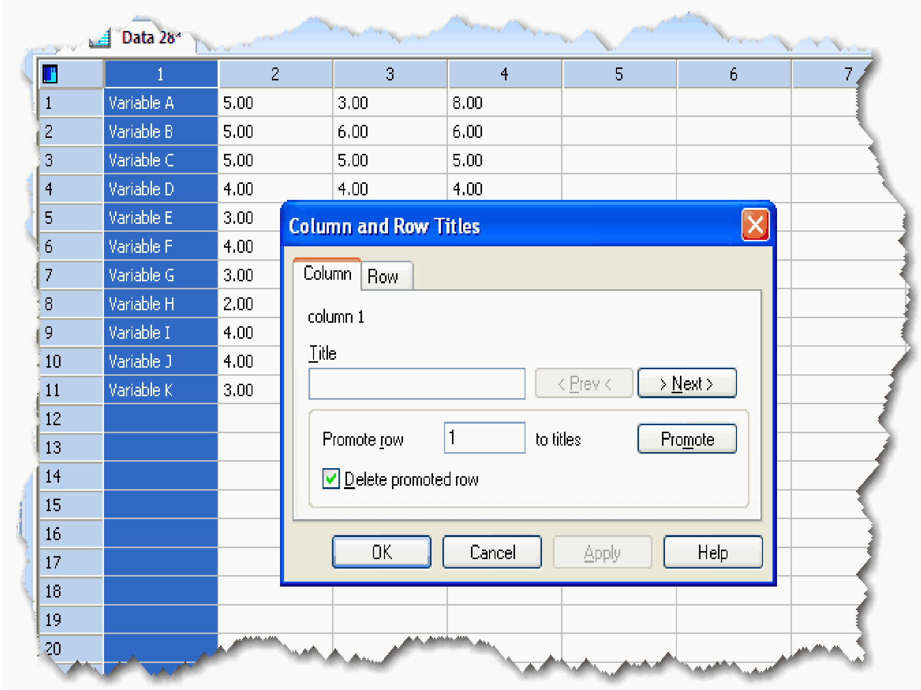
To use a row for column titles:

1. If necessary, enter the column titles you want to use in a single worksheet row.
2. Select the cells in the row you want to use as column titles.
3. On the **Worksheet** tab, in the **Cells** dialog box, click **Titles**.



4. In the **Column and Row Titles** dialog box, click the **Column** tab. The number of the row you wish to promote appears in the **Promote row to titles box**.

Figure 40. Using a Column for Row Titles



5. **To delete the original row once it has been promoted,** select **Delete Promoted Row**.
6. Click **Promote**. The selected row contents appear as column titles and the **Column and Row Titles** dialog box closes.

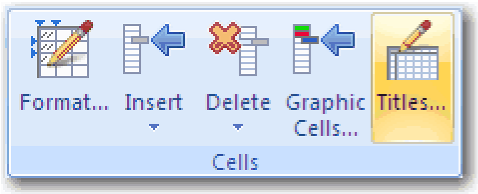
Using a Worksheet Column for Row Titles

Enter labels into a column, then use that column for worksheet row titles. This is particularly useful for data imported or copied from spreadsheets.

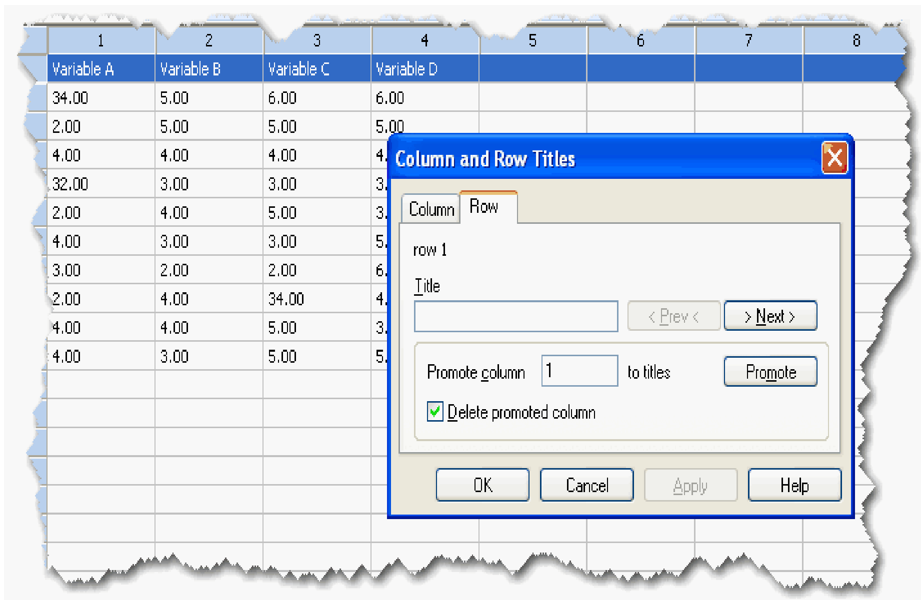
All the cells of the selected row are promoted, not just those cells which contain column titles. This may effect other data sets in the worksheet.

To use a column for row titles:

1. If necessary, enter the row titles you want to use in a single worksheet column.
2. Select the cells in the row you want to use as row titles.
3. On the **Worksheet** tab, in the **Cells** dialog box, click **Titles**.



4. In the **Column and Row Titles** dialog box, click the **Row** tab. The column you wish to promote appears in the **Promote** column to titles box.



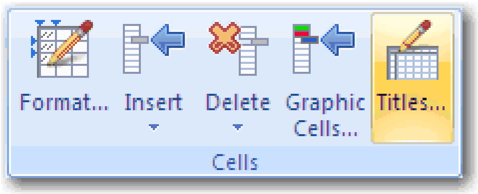
5. Select **Delete Promoted Column** to delete the original column once it has been promoted.
6. Click **Promote**. The selected column contents appear as row titles and the **Column and Row Titles** dialog box closes.

Using a Cell as a Column or Row Title

Use the Column and Row Titles dialog box to promote individual cells to column and row titles.

To promote individual cells:

1. Click the cell on the worksheet that you want to promote to a column or row title.
2. On the **Worksheet** tab, in the **Cells** dialog box, click **Titles**.



3. In the **Column and Row Titles** dialog box, click the **Column** tab to promote a row cell to title; click the **Row** tab to promote a column cell to a title.
4. Click **Next** or **Prev** to move to the next desired column or row, then follow steps above.

Removing Outliers and Other Data

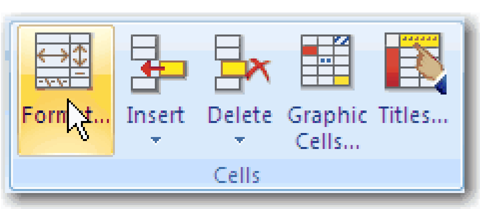
You can manually omit or ignore an outlying point or group of points by converting the number to a text cell which removes the data point from both graphing and computation.

To remove or ignore an outlier:

1. Find the outlier on the graph, then click it to select the curve, pause, and then click again (do not double-click).
2. View the worksheet. The data for the selected symbol is indicated with colored highlighting.

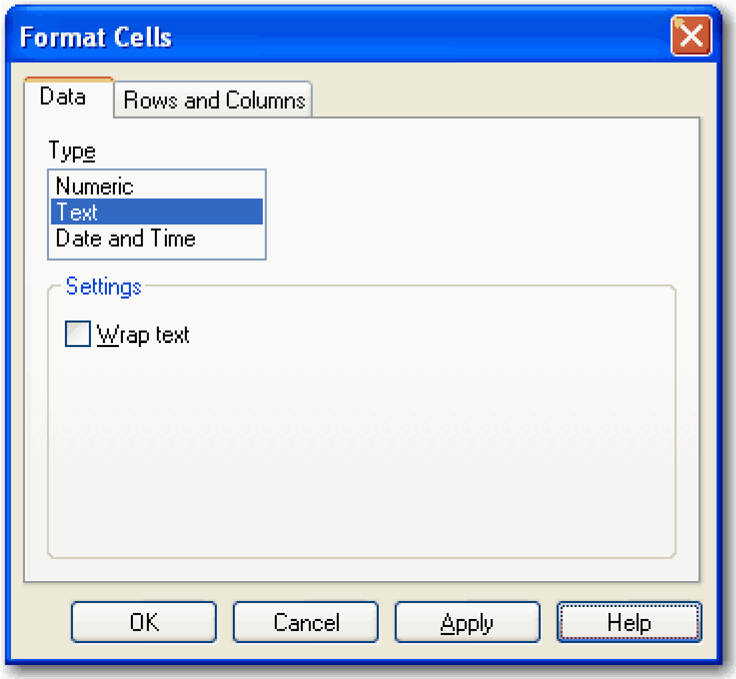
> **Tip:**
> It is possible to highlight data points only if you create graphs using symbols.

3. Select the highlighted worksheet cell(s).
4. On the **Worksheet** tab, in the **Cells** group, click **Format**.



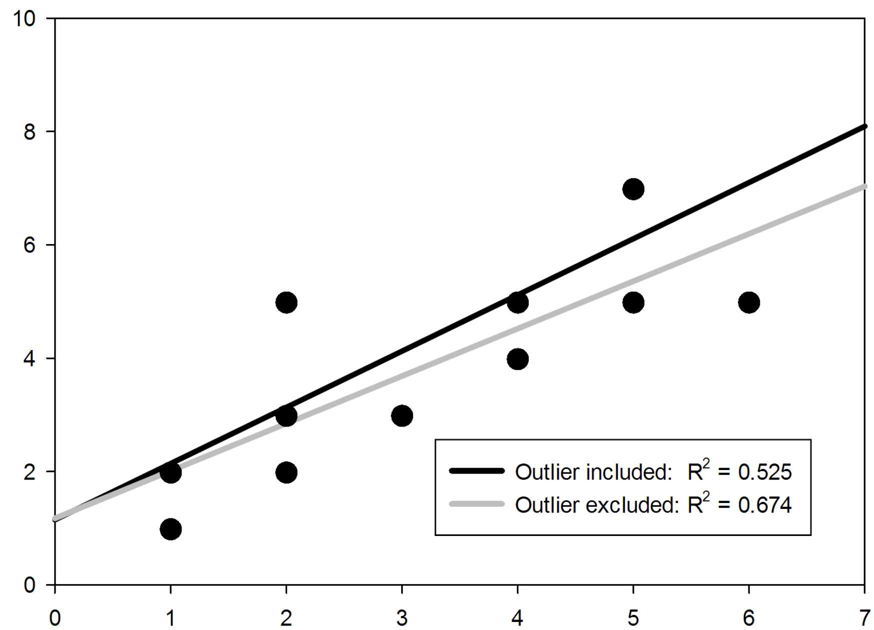
5. In the **Format Cells** dialog box, click the **Data** tab.

Figure 41. Format Cells Dialog Box



6. Select **Text** from the **Type** list, then click **OK**. This converts the number to text characters; you can tell this if the alignment of the cell changes to be left aligned.

Figure 42. Graph with Removed Outlier



The data point is no longer plotted, and if you perform additional statistics on the graph, the data point will also be ignored.

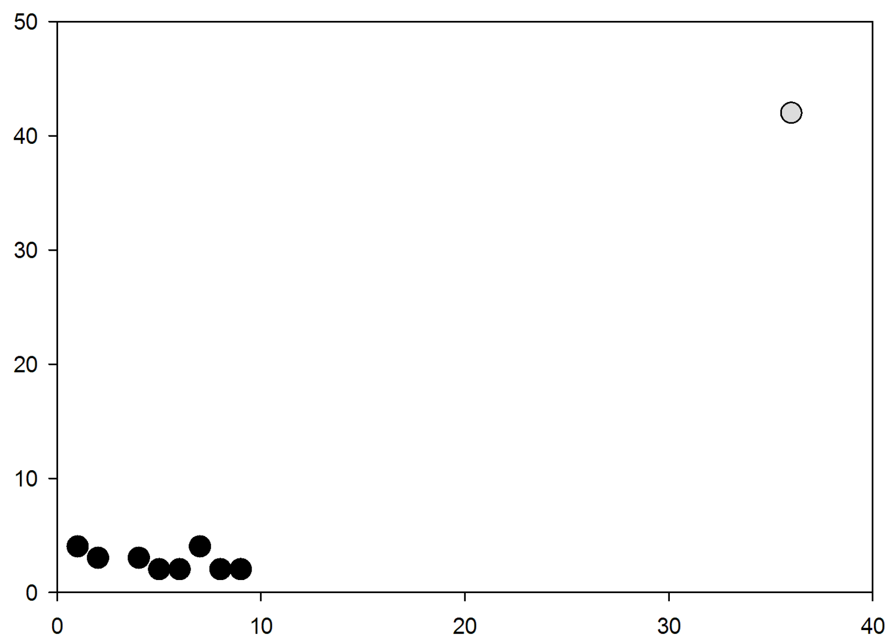
Highlighting Outliers

Another way to remove an outlier is to cut the data and move it to another part of the worksheet. This is useful if you still want to plot the data but ignore the outlier. Then you can plot the moved outlier data with a second plot to continue displaying the outlying data.

To plot outlier data as a separate plot:

1. Identify the worksheet cell(s) corresponding to the outlier(s).
2. Select (highlight) the cells, and press Ctrl+X to cut them.
3. Move to another location in the worksheet and paste the data.

4. Plot the outlier data by adding it as a second plot to your graph. Change the symbol color or other attributes to distinguish the data.



Indexing Data

You can convert raw data to indexed data and vice versa, using the **Index** and **Unindex** transforms available from the **Statistical** drop-down list in the **Transform** group on the **Analysis** tab. You can index and unindex data with one and two factors.

Creating Indexed Data

Before indexing data, add titles to the columns. The column title strings are used as the index codes.

> **Tip:**
> If you are indexing two ways, use columns titles consisting of the levels of the two factors for that table cell, separated by a hyphen (-), forward slash (/) or colon (:). These levels names will be used for the index codes.

To index data by one factor:

1. On the **Analysis** tab, in the **Transform** group, click **Statistical > Index > One Way**.
2. To index data by two factors, click **Two Way**.
3. Click the worksheet column to select the output column for the indexed data. This should be an empty column with at least one empty column to the right for a One Way ANOVA, or two empty columns for Two Way ANOVA.
4. Select the columns to index, either by clicking the worksheet columns, or selecting the column from the **Data for Input** drop-down list.
5. Click **Finish** to index the contents of the selected input columns in the selected output column. The indexed data is tabulated, with the indexes appearing in the left column(s), and the data in the right column.

Unindexing Data

Indexed data can be unindexed for graphing purposes using the Unindex command.

1. On the **Analysis** tab, in the **Transform** group, click **Statistical > Unindex > One Way**.
2. To unindex data by two factors, click **Two Way**
3. Select the columns to unindex as prompted.
4. If you unindexed two ways, each column contains the data for one cell in the Two Way ANOVA table, and the two factor levels appear as the column title, separated by a hyphen (-).

Using Excel Workbooks in SigmaPlot

SigmaPlot supports Microsoft Excel workbooks which you can use to create graphs, run transforms, and perform regressions and other statistics on your data.

Most Excel ribbons are available when Excel workbooks are viewed, as are all of SigmaPlot's functionality. When an Excel worksheet is in focus, all keyboard shortcuts are assigned to Excel's hotkeys, not SigmaPlot's.

Excel workbooks created by SigmaPlot are initially limited to a single worksheet. Excel workbooks with multiple worksheets that are opened by SigmaPlot as notebooks retain all sheets, but only the first sheet can be used for graphs and statistics.

To open a new Excel worksheet:

Click **New > Excel Worksheet**.

Using Excel as Default Workbooks

You can use Excel workbooks as the default SigmaPlot worksheet.

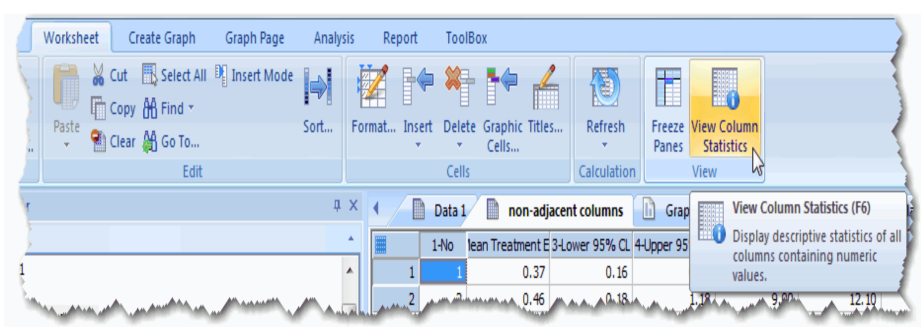
To set Excel as the default worksheet:

1. Close all open Excel workbooks.
2. Click the .
3. Click **Options**.
4. Click the **General** tab.
5. Select **New notebooks use Excel workbook**.
6. Click **OK** to apply the changes and close the dialog box. All new notebooks will use Excel workbooks as the default worksheet.

SigmaPlot Functionality within Excel Workbooks

To understand how Excel works with other applications, please see your Excel documentation. The following functions are unavailable when working with data in an in-place active Excel workbook:

- You cannot insert graphic cells into an Excel workbook for customized sequences of colors, lines, symbols, and patterns.
- An Excel workbook does not have an associated Statistics worksheet. To view statistics for data in an Excel workbook, use Excel's own statistics, or copy and paste the data into a SigmaPlot worksheet. To display the statistics worksheet for the active SigmaPlot worksheet, on the **Worksheet** tab, in the **View** group, click **View Column Statistics**.



Creating SigmaPlot Graphs With Excel Workbooks

An Excel worksheet works the same as a SigmaPlot worksheet when creating graphs. You can select data before beginning a graph, or click or highlight columns from the Graph Wizard.

Using Transforms on Data in Excel Workbooks

You can perform SigmaPlot and user-defined transforms on data in Excel worksheets. The transform language uses syntax which refers to columns numerically, or by the column titles currently assigned. When prompted to pick columns, you can select columns as you would on a SigmaPlot worksheet.

To perform user-defined transforms on an Excel worksheet, use the corresponding column number in place of the column letter that appears in the gray heading area at the top of the column. For example, the transform function:

```
col(1)=data(1,100)
```

corresponds to inserting data values from 1 to 100 into column A of an Excel workbook.

Using Statistics with Excel

You can use SigmaPlot's statistical tests, including the **Regression Wizard**, with Excel worksheets.

When prompted to pick columns, select the columns from the Excel worksheet just as you would from a SigmaPlot worksheet. Results for statistics can be placed in Excel worksheets as well.

Printing Worksheets

You can print active worksheets by . You can print any worksheet in a notebook. This section explains:

- Printing the current worksheet.
- Previewing worksheets before printing.
- Printing column statistics.
- Setting printing options.
- Configuring printer settings.

Printing the Current Worksheet

1. Select and view the worksheet. If you want to print only a portion of the columns in the active worksheet, select a block from the worksheet.
2. Click the .
3. Click **Print**.

Previewing Worksheets

1. With a worksheet in view, click the .
2. Click **Print**.

3. Click **Print Preview**.

Chapter 6. SigmaPlot Graphs Up Close

*This chapter describes basic procedures for all the SigmaPlot graph types and styles that you can find on the **Create Graph** tab.*

Though there are two groups on the **Create Graph** tab, 2D Graphs and 3D Graphs, this chapter divides these two groups into three:

- 2D Plots *(on page 245)*.
- 3D and Contour Graphs *(on page 289)*.
- Pie Charts, Polar, and Ternary Plots *(on page 311)*.

There is a fourth group not visible on the **Create Graph** tab, called Statistical Graphs *(on page 319)*. Only available on the Graph Wizard, Statistical Graphs are 2D exploratory graphs that you would normally create after running a statistical procedure *(on page)*.

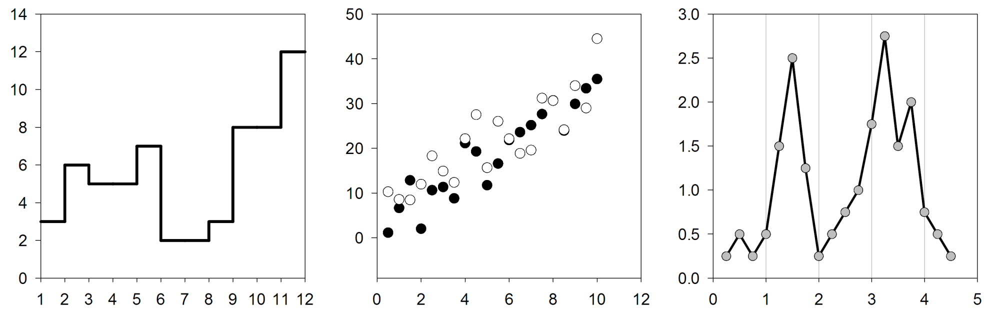
Working with 2D Plots

You can create 2D Cartesian (XY) plots from many worksheet columns or column pairs.

Each column is represented as a separate curve, set of bars, or box, depending on the plot type. 2D graphs must have at least one plot, but you also can display many more plots, each with a different type and style.

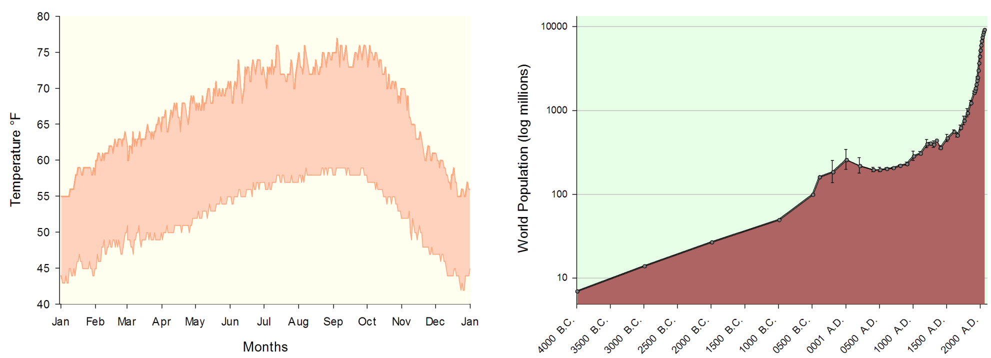
Scatter, Line, and Line and Scatter Plots

Scatter, line, and line/scatter plots graph data as symbols, as lines only with no symbols, or as symbols and lines. Line shapes can be straight segments, splines, or steps. You can add drop lines to either axis to any of these plot types, and add error bars to plots with symbols, and you can draw linear or polynomial regressions with confidence and prediction intervals for each curve.



Area Plots

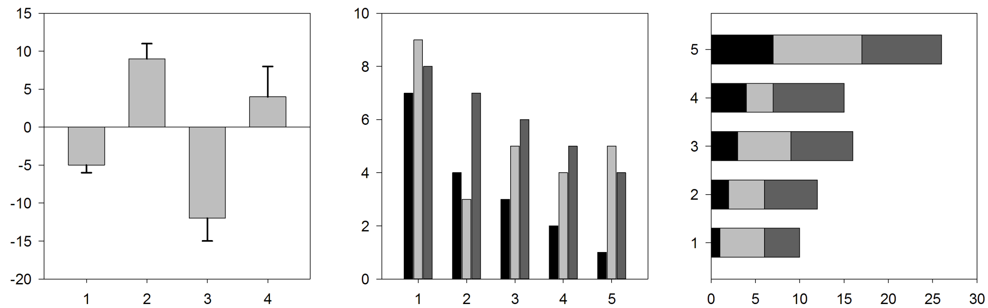
Using area plots, you can fill an area under a curve with a color making the curve easier to see. You can orient the fill up, down, left, or right. If your curve is a closed polygon, you can also fill the polygon. You can have multiple curves (plots) on a page, so you can stack Area Plots. For more information, see Creating Area Plots *(on page 269)*.



Bar Charts

Bar charts plot data either as vertical or horizontal bars. They originate from zero in either a positive or negative direction. Simple bar charts plot each row of data as a separate bar, and grouped bar charts plot multiple columns of data by grouping data in the same rows. Stacked bar charts plot data as segments of a bar; each data point is drawn as a bar segment starting where the previous data point ended.

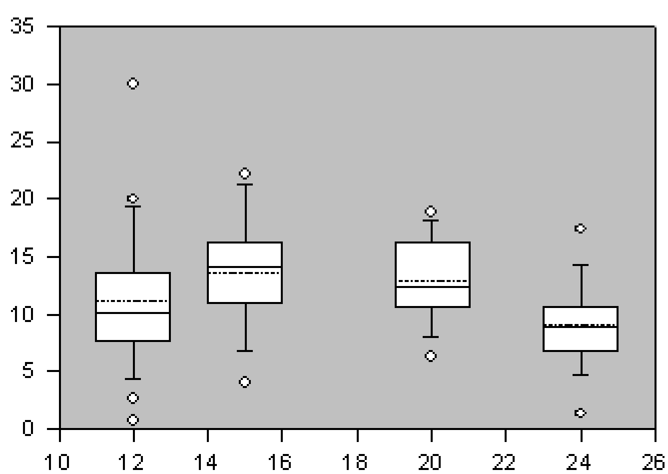
Use Graph Properties to modify bar width, bar fill colors, and bar fill patterns and to add error bars to simple and grouped bar charts. For more information, see Grouped Bar Charts *(on page 262)*.



Box Plots

Box plots graph data as a box representing statistical values. The boundary of the box closest to zero indicates the 25th percentile, a line within the box marks the median, and the boundary of the box farthest from zero indicates the 75th percentile. Whiskers (error bars) above and below the box indicate the 90th and 10th percentiles. In addition, you can graph the mean and outlying points.

You need a minimum number of data points to compute each set of percentiles. At least three points are required to compute the 25th and 75th percentiles, and at least nine points are required for the 5th, 10th, 90th and 95th percentiles. If SigmaPlot is unable to compute a percentile point, the related graph element is not drawn.



Creating 2D Plots

To create a 2D plot:

1. Select the worksheet columns to plot before creating your graph by dragging the pointer over your data.
2. Select the desired graph type and style from the **Create Graph** tab. The **Graph Wizard** appears.
3. From the **Data Format** list, choose the appropriate data format, and click **Next**.
4. Specify which worksheet columns correspond to the data for your plot. Since you selected columns prior to opening the **Graph Wizard**, your choices automatically appear in the dialog box and you can click **Finish** to create the graph.

 Note:
 If you have not already picked columns, note that a single data type is highlighted in the **Selected Columns** list. This shows the data type you are picking a column for. Begin picking data either by clicking the corresponding column directly in the worksheet, or choosing the appropriate column from the **Data Columns** list. Repeat this process for every column you are using to create your graph.

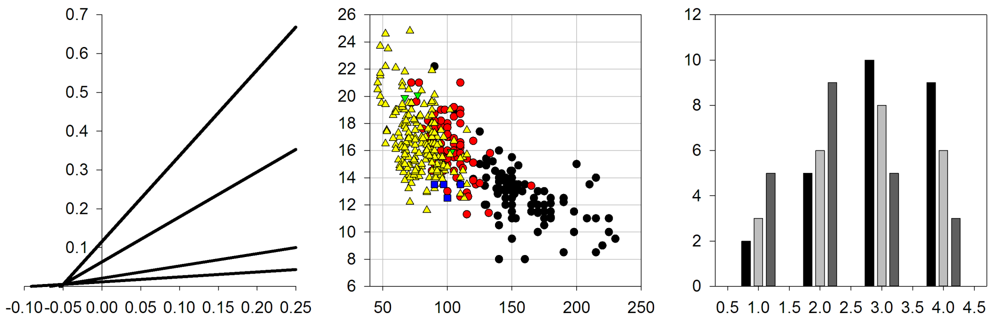
5. If you make a mistake while picking data, select the wrong entry in the **Graph Wizard**, then choose the correct column from the worksheet. You can also clear a column assignment by double-clicking it in the list.
6. When you have finished picking data, click **Finish** to create the plot and close the Graph Wizard. Use **Graph Properties** to modify the plot, or reopen the Graph Wizard to pick different data columns for your plot, or to add another plot to your graph. For more information, see Creating and Modifying Graphs *(on page 52)*.

Creating 2D Plots with Multiple Curves

You do not have to create multiple plots to obtain multiple curves. To plot more than one curve, choose any of the plot styles described as *Multiple* and add additional columns, or column pairs to the list of curves in the Graph Wizard. Both the **Graph Wizard** and the graph styles available on the **Create Graph** tab list all types of multiple plot graph styles.

The order of the curves is determined by the order of the column pairs in the Graph Wizard. To change the curve order, select columns again in the Graph Wizard or select the column in the worksheet.

Figure 43. Plot Styles that Include Multiple Curves



Plotting Category and Grouped Data

Use the **Category Data** formats (indexed data) if your data is organized row-wise by categories with corresponding data. For more information, see Arranging Category Data *(on page 94)*.

Figure 44. The data in this worksheet is arranged as category (or indexed) data. The data is organized row-wise by categories.

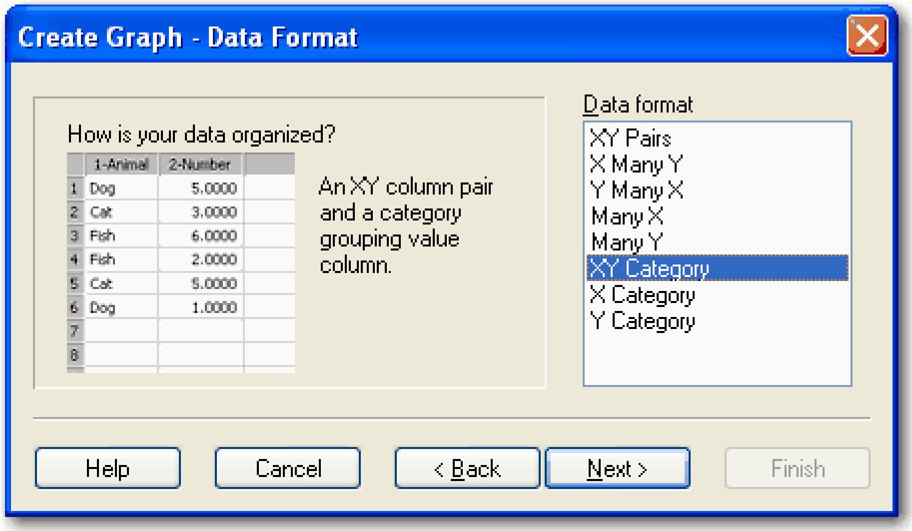

Data 1*

	1-Animals	2-Dose Response	3-Heat	4	5
1	Dogs	2.30	100.00		
2	Dogs	3.00	200.00		
3	Dogs	5.23	300.00		
4	Dogs	4.78	400.00		
5	Dogs	4.32	200.00		
6	Cats	2.30	400.00		
7	Cats	4.75	200.00		
8	Cats	4.12	100.00		
9	Cats	4.80	350.00		
10					
11					

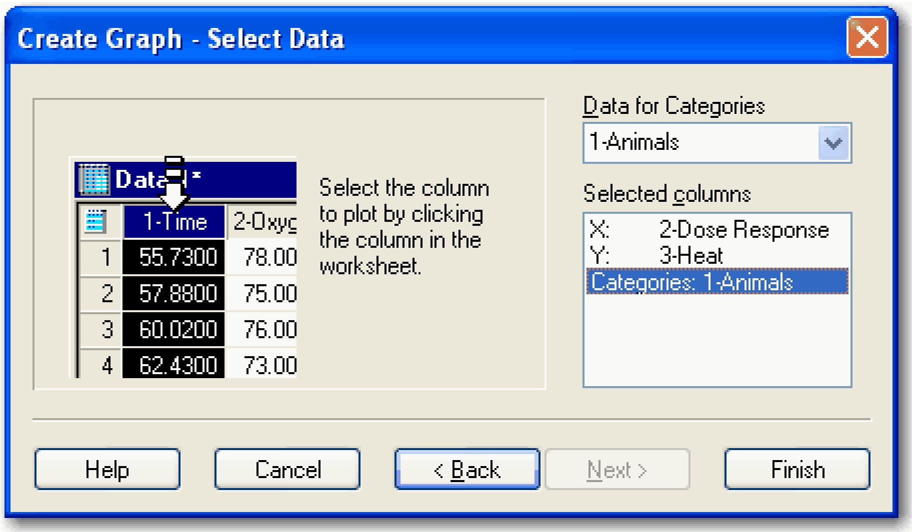
To plot category (grouped) data:

1. Select any multiple graph style for any one of these following graph types on the **Create Graph** tab:
    - Scatter Plot
    - Line Plot
    - Line/Scatter Plot

Figure 45. Selecting a Category data format from the Graph Wizard.



2. In the **Data Format** panel of the **Graph Wizard**, select one of the following category data formats:
    - **XY Category.** Uses one worksheet column to graph the categories, and a pair of XY columns.
    - **X Category.** Uses one X column, and a column for categories, indexes, or levels to group the data in corresponding rows.
    - **Y Category.** Uses one Y column, and a column for categories, indexes, or levels to group the data in corresponding rows.
3. Click **Next**. The **Select Data** panel of the **Graph Wizard** appears.
4. Select which data columns will correspond to which axis or category. For example, if you are using an **XY Category Data** format, first select the column to use for the **X data** from the **Data for** drop-down list. This selection appears in the **Selected columns** list. Then select the column to use for the **Y data** from the drop-down list. Lastly, select the column to use as the **Categories** from the drop-down list.



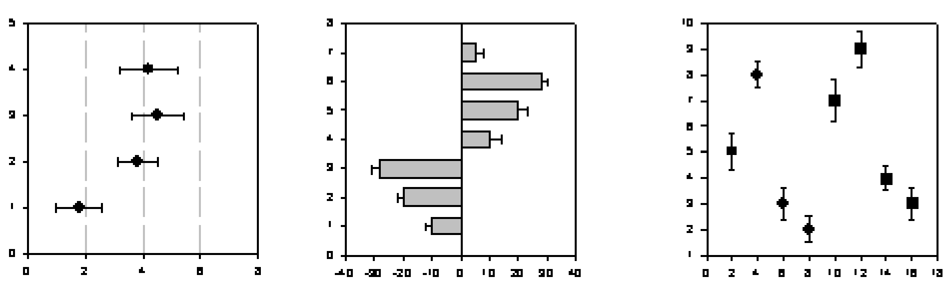
5. **If you make a mistake while picking data,** select another entry in the Graph Wizard, then choose the correct column from the worksheet. You can also clear a column assignment by double-clicking it in the list.
6. When you have finished picking data, click **Finish** to create the plot and close the Graph Wizard. Use **Graph Properties** to modify the plot, or reopen the Graph Wizard to pick different data columns for your plot, or to add another plot to your graph. For more information, see Creating and Modifying Graphs *(on page 52)*.

Creating 2D Scatter Plots with Error Bars

In a Line and Scatter Plot with Error Bars, plot the means of each column as the Y value, and represent the standard deviations with error bars.

Use the Graph Wizard to create 2D plots with error bars. Scatter plots, line/scatter plots, or simple bar charts can be created with error bars. For more information, see SigmaPlot Graph Styles *(on page 55)*

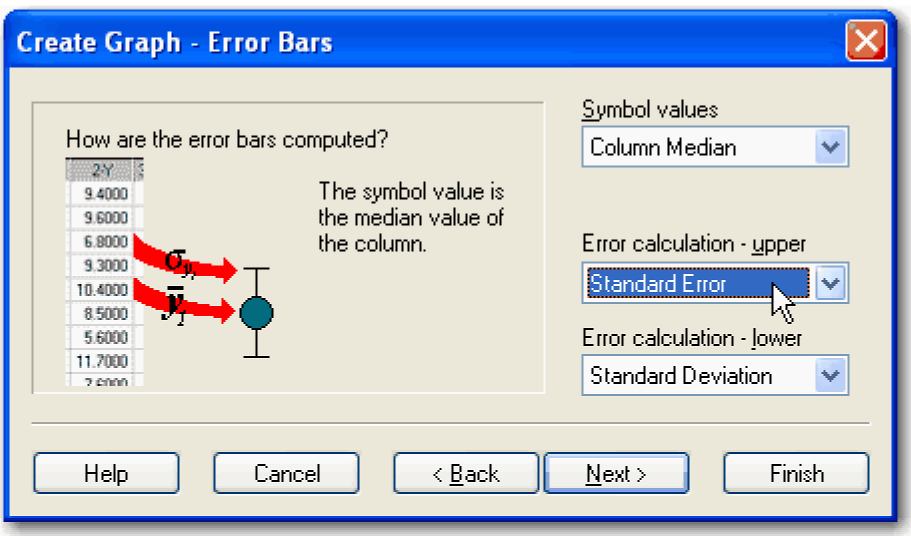
Figure 46. 2D Plots with Error Bars



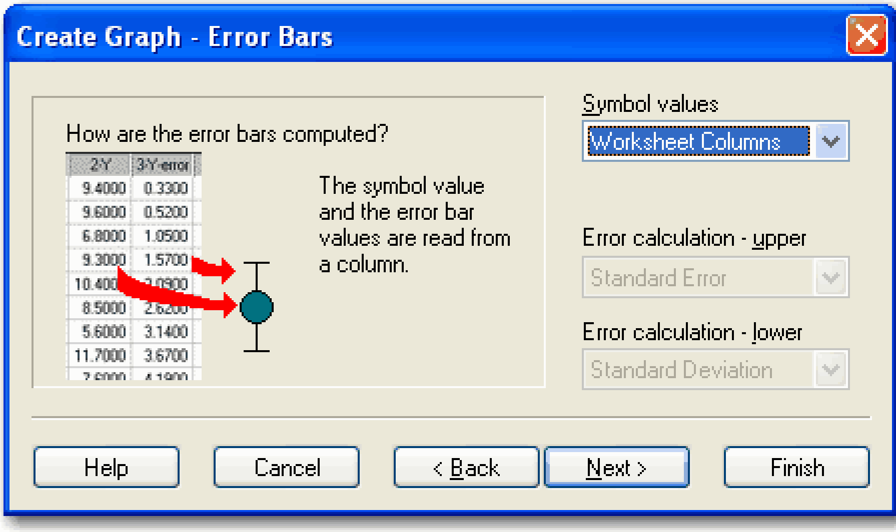
To add error bars to an existing plot, first change the plot type. For more information, see Creating and Modifying Graphs *(on page 52)* .

To create a scatter plot with error bars:

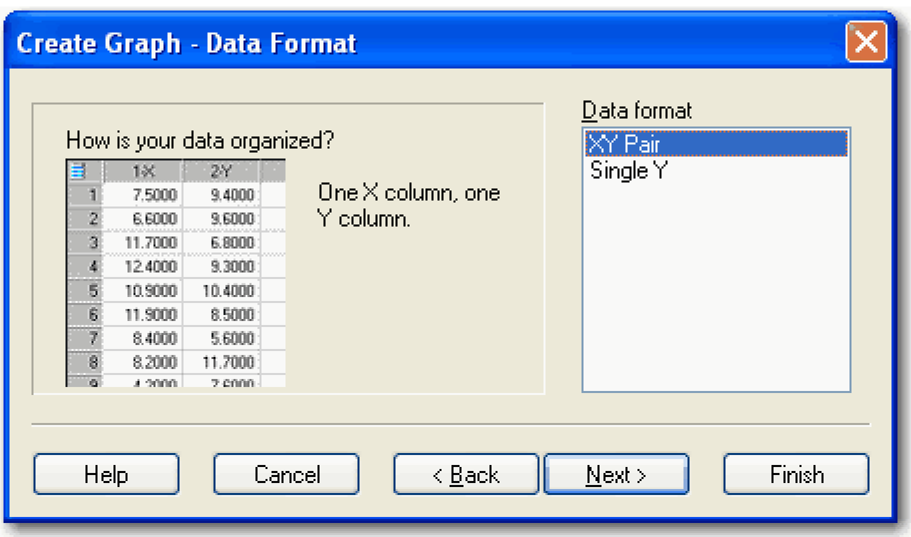
1. Select the worksheet columns to plot before creating your graph by dragging the pointer over your data.
2. On the **Create Graph** tab, click the **Scatter** group, and then click **Simple Scatter - Error Bars**.
3. In the **Graph Wizard**, select the error bar source from the **Symbol Value** drop-down list.
   - **Symbol Value.** Choose either **Column Means** to use the column means as the error bar source, **Replicate Row Means** to use the row means as the error bar source, **Worksheet Columns** to use values you've entered in the worksheet, or **2 Worksheet Columns** to read error bar end values from sets of two adjacent columns. You are prompted during data picking to specify the column to use as error bar source data.



   - **Error Calculation.** If you choose any option besides **Worksheet Columns** as the symbol value, specify the error calculation method to use for upper and lower error bars.

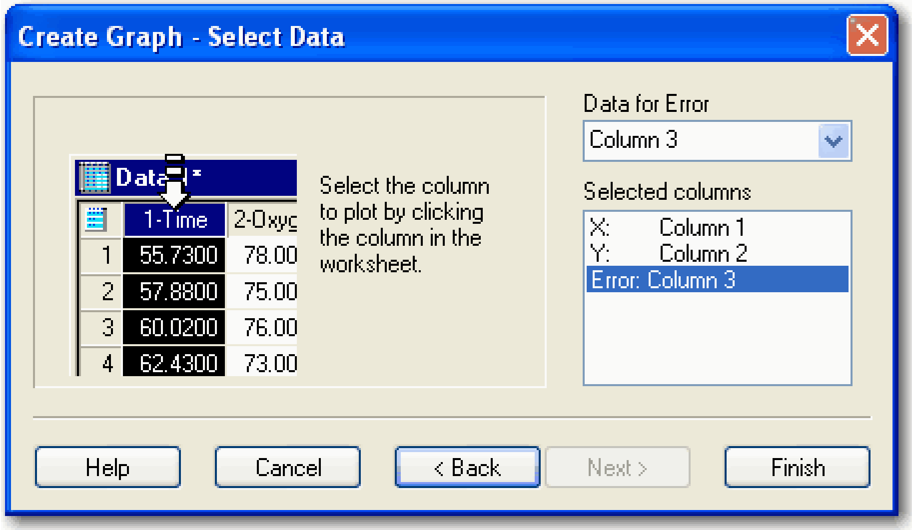


4. Specify the error calculation for the error bars from the **Error Calculation - Upper and Error Calculation - Lower** drop-down lists. **Error Calculations** are not applicable if you select **Worksheet Columns** or **Asymmetrical Error Bars** from the **Symbol Value** list.
5. Click **Next**.



6. Select the appropriate data format from the **Data Format** list. X column averaged plots require a constant Y column value, and Y column averaged plots require a constant X column value.
7. Click **Next**.

Figure 47. Specifying the Data Columns for the Error Bars



8. Specify which worksheet columns correspond to the data for your plot. Since you selected columns prior to opening the Graph Wizard, your choices automatically appear in the dialog box, and you can click **Finish** to create the graph.
9. **To create a single plot graph,** choose data for every column you are using to make the graph. To create a graph of multiple plots, choose data for the first plot, then click **Next** to pick data for the next plot. Repeat this process for as many plots as necessary.
10. **To make a graph with simple error bars or a graph with multiple error bars using worksheet columns as the Symbol Value for error bar data,** you are prompted to choose columns for error bar data. Repeat the data picking process for every column you are using to create your plot.
11. **To make a graph using any of the other sources for error bar data (i.e. Column Means, Column Median, Standard Error, etc.) with multiple error bars,** you can create a graph using a single plot, or a graph with multiple plots. Use multiple plots if you want to use different symbols to distinguish between data sets.

> **Tip:**
> If you make a mistake while picking data, click the wrong entry in the Graph Wizard, then choose the correct column from the worksheet. You can also clear a column assignment by double-clicking it in the **Selected Columns** list. Click **Back** to access previous Graph Wizard panels.

12. Click **Finish** when you have finished picking the data to create the plot.

Creating a Range Plot

A range plot is an error plot that plots the highest and lowest values in a column or row of data as the range of the error bar, using the mean or median value as the data point.

To create a range plot from columns of data:

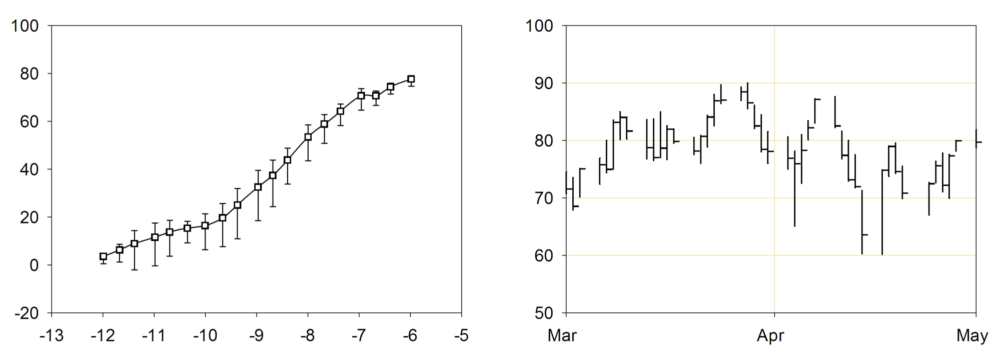
1. Select the worksheet columns to plot before creating your graph by dragging the pointer over your data.
2. On the **2D Graph** toolbar click **Scatter Plot** and then **Simple Scatter - Error Bars**.
   The **Graph Wizard - Create Graph** dialog box appears.
3. Select **Column Means** or **Column Median** from the **Symbol Value** drop-down list.
4. Select **Maximum** from the **Error Calculation - Upper** drop-down list.
5. Select **Minimum** from the **Error Calculation - Lower** drop-down list.
6. Click **Next**. The **Graph Wizard** prompts you to select a data format.
7. Select **X Many Y** from the **Data Format** list, and click **Next**.
   Since you've already selected the data columns to plot, the appropriate column titles appear in the **Selected Columns** list.
8. Click **Finish**. A range plot appears.

Creating 2D Plots with Asymmetric Error Bars

Create 2D scatter plots with error bars using two adjacent worksheet columns as the error bar source to independently control the error bar values. SigmaPlot computes the asymmetrical error bars by using the column value as the absolute value.

The column to the right of the plotted data is the source for the bottom or left error bar; the next column is the source for the top or right error bar.

Figure 48. 2D Plots with Asymmetrical Error Bars



To create a plot with asymmetric error bars:

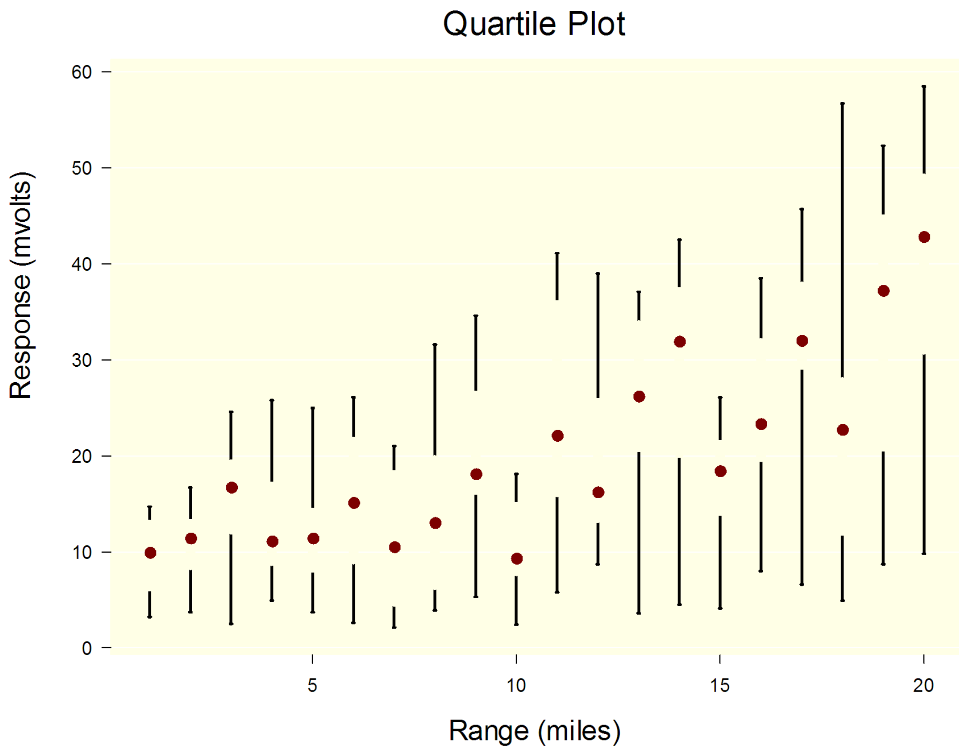
1. Drag the pointer over your worksheet data to select the data.
2. On the **Create Graph** tab, click **Scatter Plot**, and then click either **Simple Scatter - Vertical Asymmetrical Error Bars** or **Simple Scatter - Horizontal Asymmetrical Error Bars**.
   The Graph Wizard appears.
3. From the **Data Format** list, select a data format, and click **Next**.
4. Specify which worksheet columns correspond to the data for your plot. For more information, see Modifying Graphs Using Graph Properties *(on page 89)*.
   Since you selected columns prior to opening the Graph Wizard, your choices automatically appear in the **Selected Columns** list.
5. Click **Finish** to create the graph. Modifying Error Bars *(on page 258)*

Creating Quartile Plots

A quartile plot is an asymmetrical error bar plot that divides the total sample of a frequency distribution into four quarters. The median of the data is the data point, while the 75th and 25th percentiles of the data represent the upper and lower error bars.

By default, SigmaPlot uses the Standard method to calculate percentile values for box and quartile plots. You can change this setting to the Cleveland method on the General tab of the Options dialog box.

Figure 49. Example of a Quartile Plot



To create a quartile plot:

1. Select the worksheet columns to plot before creating your graph by dragging the pointer over your data.
2. On the **2D Graph** toolbar click **Scatter Plot** and then **Multiple Scatter - Error Bars**. The **Graph Wizard - Create Graph** dialog box appears.
3. Select **Column Median** from the **Symbol Value** drop-down list.
4. Select **75th Percentile** from the **Error Calculation - Upper** drop-down list.
5. Select **25th Percentile** from the **Error Calculation - Lower** drop-down list.
6. Click **Next**. The **Graph Wizard** prompts you to select a data format.
7. Select **X Many Y** from the **Data Format** list, and click **Next**.
8. Since you've already selected the data columns to plot, the appropriate column titles appear in the **Selected Columns** list.
9. Click **Finish**.

Creating Error Bar Plots Using Category Data

You can create SigmaPlot error bar plots using category data entered into a SigmaPlot worksheet. For more information, see Plotting Category and Grouped Data *(on page 249)*.

To create a SigmaPlot error bar plot using category data:

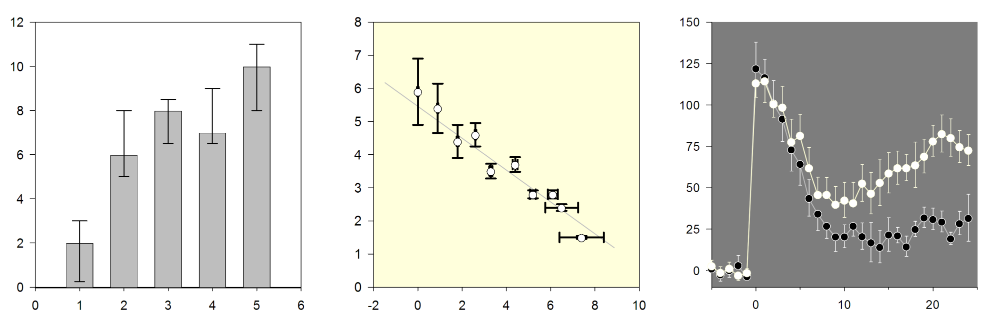
1. Open or import a worksheet using a category data format. For more information, see Worksheet Basics (on page 200).
2. On the **2D Graph** toolbar click **Scatter Plot** and then **Multiple Scatter - Error Bars**.
   The **Graph Wizard - Create Graph** dialog box appears.
3. Select a graph style that uses error bars from the **Graph styles** list, and click **Next**.
   The **Create Graph - Error Bars Graph Wizard** dialog box appears.
4. Select either **Category Mean** or **Category Median** from the drop-down list.
5. Select error calculations from the **Error calculation - upper** and **Error calculation - lower** drop-down lists, and click **Next**.
   The **Graph Wizard - Create Graph - Data Format** dialog box appears.
6. From the **Data for Categories** drop-down list, select a column that corresponds to the categorical data you wish to plot.
7. From the **Data for Y** drop-down list, select the column that corresponds to the **Y data** you wish to plot.
8. Click **Finish**.
   An error bar plot appears.

Modifying Error Bars

You can compute error bars for scatter, line/scatter, and bar charts. You select error bar values when you pick the data for a plot and compute using values in a worksheet column or using column means.

Note:
You cannot add error bars to existing plots. However, you can select the desired plot on the page and change its plot type and style so that it includes error bars. For more information, see Modifying Graphs Using Graph Properties (on page 89).

Figure 50. Examples of Graphs with Error Bars



Changing Error Bar Appearance

Use **Graph Properties** to change error bar color, cap width, line thickness, mean computation method, and direction.

Note that you cannot select error bar values from the **Graph Properties**, as it only affects the appearance of error bars. Determine error bar values when you pick data to plot.

To change error bar appearance:

1. Double-click the plot to open **Graph Properties**.
2. In the **Properties** list select **Plot > Error bars**.
3. **To change the color of the error bars,** from the **Line Color** list, select a line color.
4. **To change line thickness and error bar cap width,** move the **Thickness** and **Cap Width** sliders.

Changing Error Bar Directions

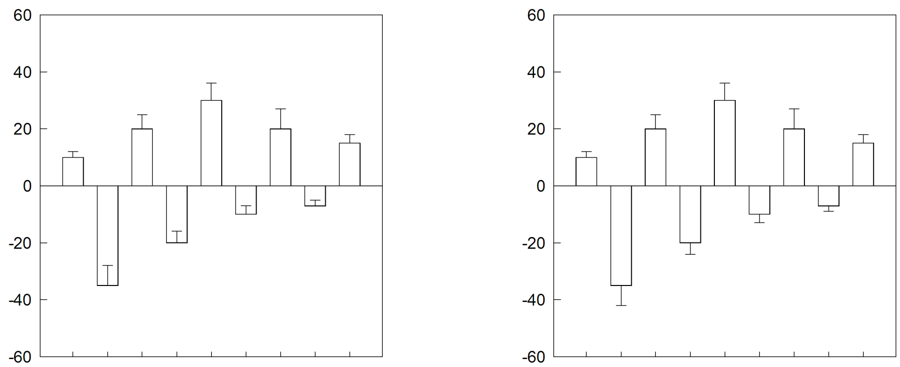
You can specify error bar direction using two different methods: absolute and relative. Specify absolute error bars to point in either a positive or negative direction; specify relative error bars to point either towards or away from zero.

To change error bar direction

1.
2. From the **Properties** list, select **Plot > Error Bars**.
3. Under **Error Bars**, from the **Direction** drop-down list, select the direction of Y.

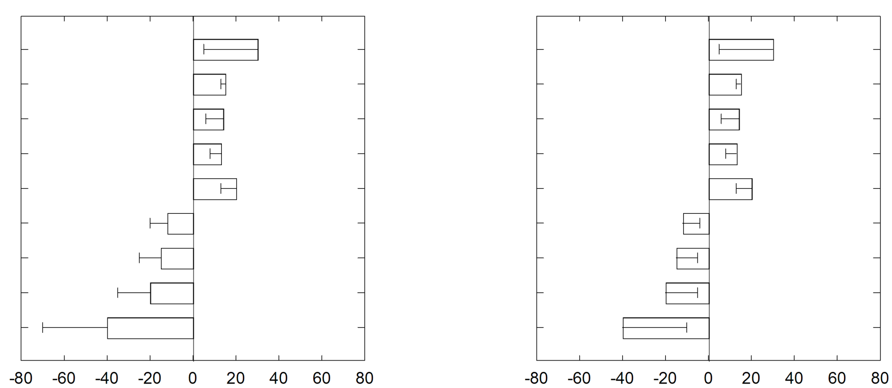
> **Note:**
> An X positive absolute direction always points right; a Y positive direction always point up. An X negative absolute direction always points left; a Y negative absolute direction always points down.

Figure 51. The bar chart on the left uses Y error bars with an absolute positive direction. The bar chart on the right uses a relative direction away from zero.



A relative to zero direction always points toward or away from zero. This option is useful for bar charts that have negative values.

Figure 52. The bar chart on the left uses X error bars with an absolute negative direction. The bar chart on the right uses a relative direction towards zero.



Customizing Error Bar Directions

You can customize the error bar direction used for each data point by entering error bar directions into a worksheet column.

To use custom error bar directions:

1. Select the first cell in an empty worksheet column.
2. Enter the codes for the error bar directions. The codes for the directions are:

Direction	Code
Absolute Positive	Positive or P
Absolute Negative	Negative or N
Relative From Zero	From Zero or F
Relative To Zero	To Zero or T
Absolute or Relative, Both Directions	Both, PN or FT

Tip:
Codes you type in the worksheet can be either upper or lower case.

3. Double-click the plot to open **Graph Properties**.
4. If necessary, select **Plot > Error Bars** from the **Properties** list.
5. Under **Error bars**, from the **Direction** list, choose the name of the first column which contains the error bar direction codes.

Note:
SigmaPlot assumes that it is the next column that contains the second column of error bar codes.

Changing the Mean Computation Method

If your graph uses a log axis scale, you can choose between calculating the column means arithmetically (the default) or geometrically on a log scale. This option is only available for log axis scales.

To change the mean computation method:

1. Double-click the plot to open **Graph Properties**.
2. If necessary, select **Plot > Error Bars** from the **Properties** list.
3. Select **Arithmetic** or **Geometric** from the **Mean Computation** drop-down list.

Changing Error Bar Source

Use this method to change the error bar source after you have created a graph. You can:

- Plot the means of worksheet columns as single data points and compute the error bars values from column statistics (column averaging).
- Use data in worksheet rows and columns as error bar values.
- Use data in two adjacent worksheet columns as the absolute error bar values.

To change the error bar source after you have created the graph:

1. Click the **Graph Page** tab.
2. Click **Modify Plot** in the **Graph Additions** group.
3. Assuming you want to continue to use worksheet columns as the error bar source, continue to click **Next** until you reach the **Modify Plot - Select Data** panel of the **Graph Wizard**.
4. Select a new column in the worksheet for the error bars source so that it appears in the **Selected columns** list.
5. Click **Finish**.

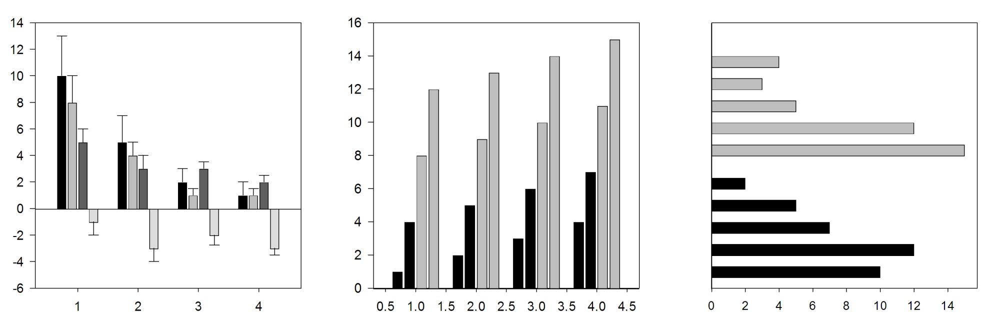
Grouped Bar Charts

You can create grouped bars charts by picking multiple columns for a single plot. Data points within the same row appear within the same group, and each additional column adds another bar to each group. There are as many groups as there are rows of data.

The order of the column pairs in the list determines the order of the bars for each group. To change the bar orders within groups, change the order the column pairs appear in the list by using the Graph Wizard to re-pick column data. For more information, see Modifying Graphs Using Graph Properties *(on page 89)*.

Use the **Graph Wizard** to create grouped bar charts with or without error bars. If creating a grouped bar chart with error bars, error bar values must be from worksheet column values entered prior to creating the plot. You are prompted during graph creation for error bar worksheet columns.

Figure 53. Examples of Grouped Bar Charts with and without Error Bars



Creating Grouped Bar Charts

To create a grouped bar chart:

1. Select the worksheet columns to plot before creating your graph by dragging the pointer over your data. For more information, see Modifying Graphs Using Graph Properties *(on page 89)*.
2. Click the **Create Graph** tab.
3. In the **2D Graphs** group, click **Horizontal** or **Vertical Bar Chart**, and then click either **Grouped Bar Chart**, or **Grouped Error Bars**.
   The **Graph Wizard** appears.
4. From the **Data Format** list, choose the appropriate data format to specify how your data is formatted. The data formats available depend on the graph type and style.
5. Click **Next**.
   Since you selected columns prior to opening the Graph Wizard, your choices automatically appear in the in the **Selected Columns** list. To change the selected data, select the wrong entry in the Graph Wizard, then choose the correct column from the worksheet. You can also clear a column assignment by double-clicking it in the **Selected Columns** list.
6. Click **Finish**. For more information, see Modifying Error Bars *(on page 258)*.

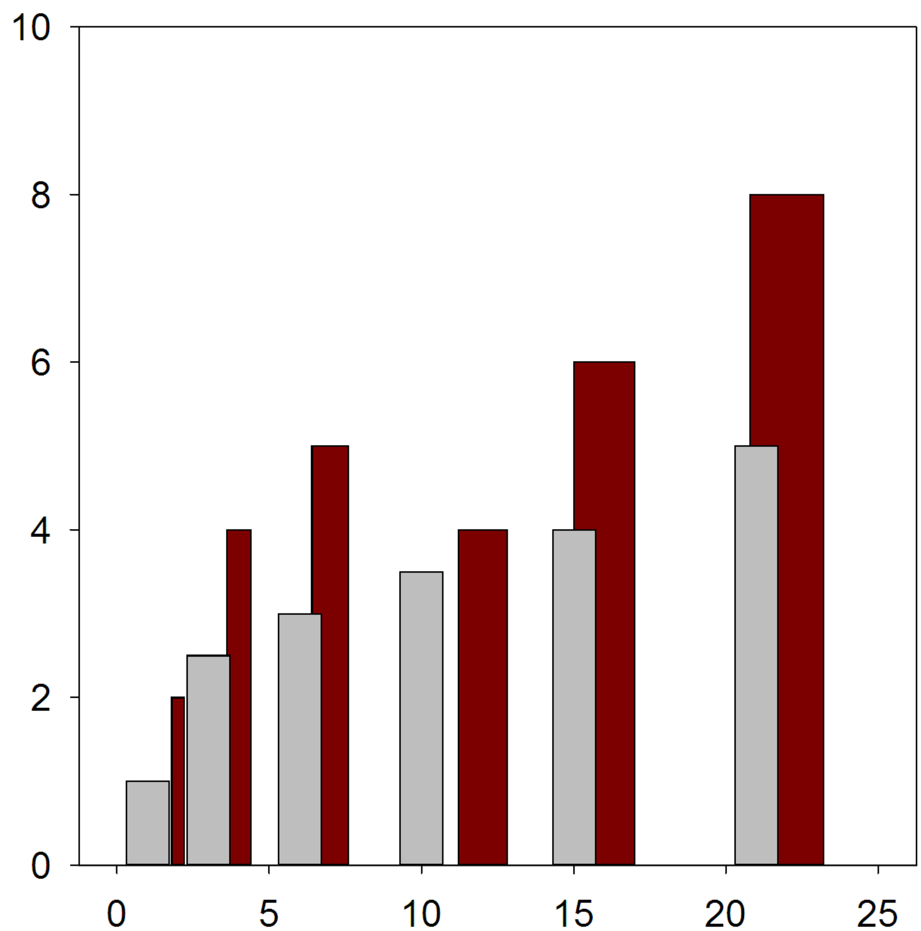
Spacing Bars from Different Plots

If you need to create a bar chart with two or more different axes scales, or a chart with overlapping bars, use multiple plots.

SigmaPlot does not automatically space bars from different plots. However, you can manually space bars by grouping your data column(s) with column(s) containing missing or empty data. This creates bar groups with null values and leaves room for other bars. When picking columns to plot, pick the missing columns in a different order for each plot, so that the bars do not overlap.

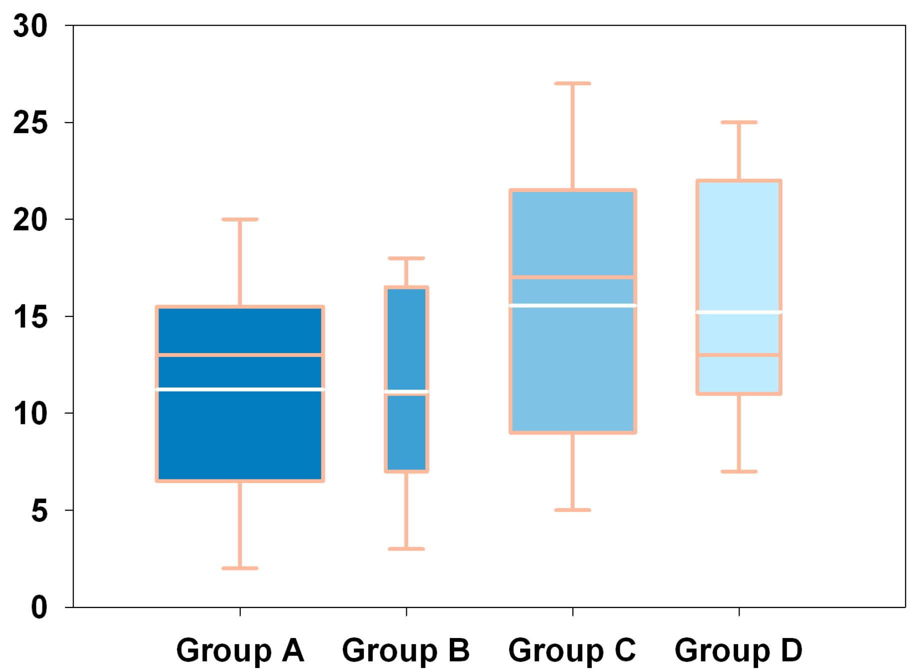
To overlap bars, plot your bar values versus a column of evenly incremented values rather than by row numbers.

Figure 54. Bars graphed with different plots that both overlap and are spaced differently by using different x increments.



Creating Box Plots

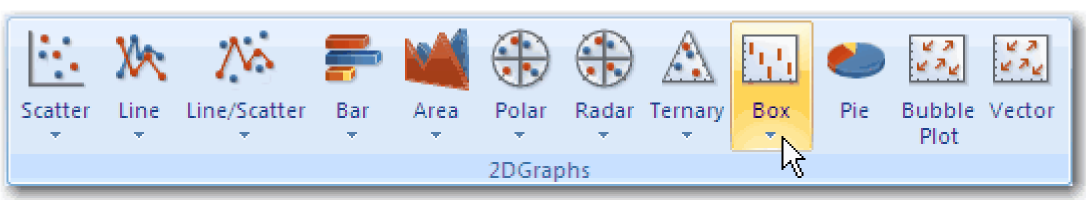
A box plot is a summary plot that plots graph data as a box representing statistical values. The boundary of the box closest to zero indicates the 25th percentile, a line within the box marks the median, and the boundary of the box farthest from zero indicates the 75th percentile. Whiskers (error bars) above and below the box indicate the 90th and 10th percentiles. In addition, you can graph the mean and outlying points.



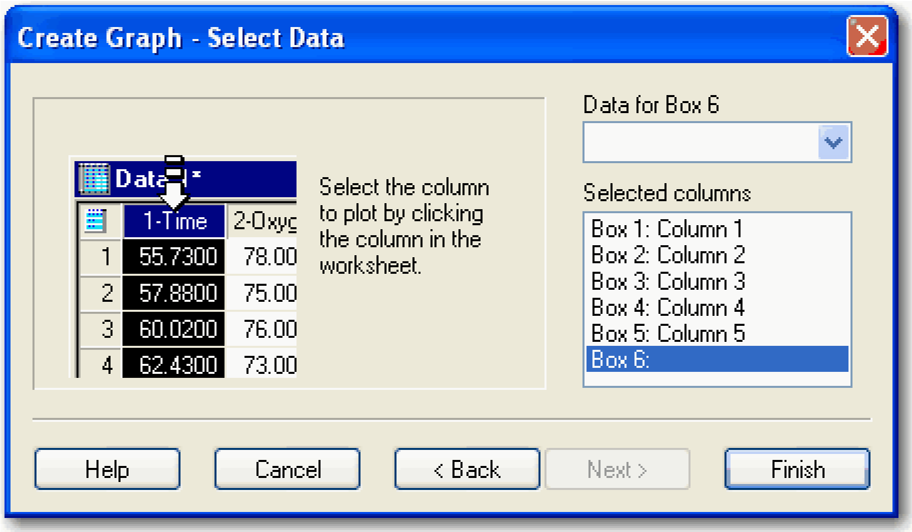
By default, SigmaPlot uses the Standard method to calculate percentile values for box and quartile plots. You can change this setting to the Cleveland method on the General tab of the Options dialog box.

To create a box plot:

1. Select the worksheet columns to plot by dragging the pointer over your data.
2. On the **Create Graph** tab, in the **2DGraph** group, click **Box Plot**.



3. Click **Horizontal Box** or **Vertical Box**.
4. From the **Data Format** list, choose the data format that you want to use, and click **Next**. Since you already selected columns prior to opening the Graph Wizard, your choices automatically appear in the **Selected Columns** list.



Important:

You need a minimum number of data points to compute each set of percentiles. At least three points are required to compute the 25th and 75th percentiles, and at least nine points are required for the 5th, 10th, 90th and 95th percentiles. If SigmaPlot is unable to compute a percentile point, that set of points is not drawn.

5. Click **Finish** to create the graph.
   Use **Graph Properties** to modify the plot, or reopen the **Graph Wizard** to pick different data columns for your plot, or to add another plot to your graph.

Changing Other Box Plot Attributes

To add a mean line, change which outliers are displayed, and change the 10th and 90th percentile whisker cap widths:

1. Double-click the plot to open **Graph Properties**.
2. If necessary, select **Plot > Box Options** from the **Properties** list.
3. **To display a mean line in addition to the median line,** under **Box Plot Mean Line**, select **Display Mean Line**. If the check box is clear, the mean line is not displayed.
4. **To modify the mean line,** under **Box Plot Mean** line, from the **Line Type** drop-down list, select a mean line type.
5. Select a line thickness and color using the **Thickness** and **Color** options.

Selecting **(none)** from the **Line Type** or **Color** lists creates a transparent mean line. Selecting **(Custom)** from the color list enables you to use a custom mean line color, or to create a new color.

6. **To change how outliers are handled,** from the **Handling Outliers** drop-down list, select either **Show Each Outlier** (to plot outside the 10th and 90th percentiles), or **Show 5th/10th Percentiles** (to plot only the 5th and 95th percentiles as symbols).

> **Remember:**
> You need at least nine data points to compute the 5th, 10th, 90th and 95th percentiles. Also, there may be no data points beyond the 10th and 90th percentiles.

7. **To modify whisker cap width,** under **Whisker Caps**, move the **Width** slider, or type a new value in the **Width** box.

Modifying Box Plots

The fill, width, and symbol settings for the boxes can be modified using the appropriate Graph Properties settings.

You can change:

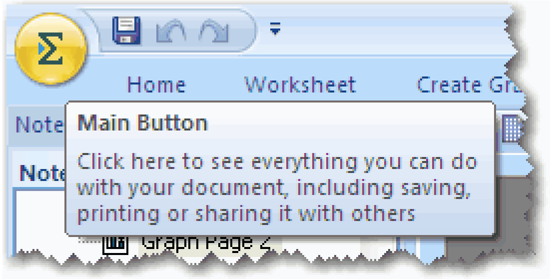
- Symbols used to display extreme data points. For more information, see Changing Symbol Type and Other Symbol Options *(on page 94)*.
- Box fill color and patterns (including edge and whisker color). For more information, see Changing Object Fills *(on page 174)*
- Box widths.

Computing Percentile Methods

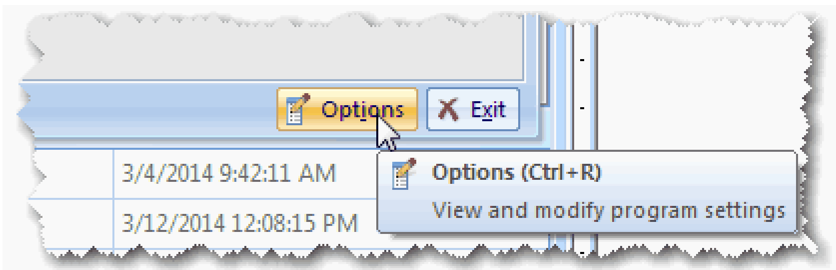
When graphing error bars and creating box plots, you can select the method of computing percentiles.

To compute the percentile method:

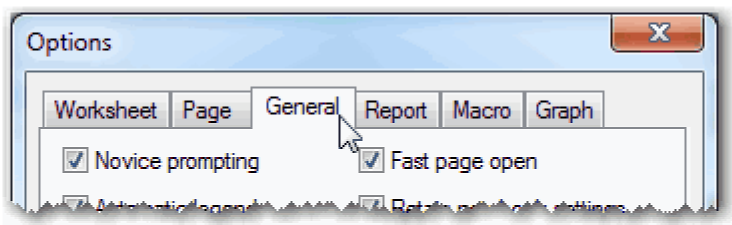
1. Click the **Main Button**.



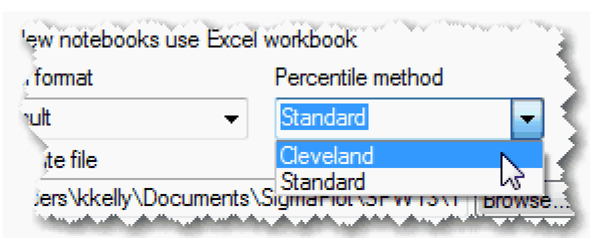
2. Click **Options**.



3. On the **Options** dialog box, click the **General** tab.



4. From the **Percentile Method** drop-down list, select either:
    - Cleveland
    - Standard



Both the Cleveland method and the Standard method use linear interpolation to determine the percentile value, but each uses a different method of rounding when determining the smallest data index used for the interpolation. The two methods give the same result when computing the 50th percentile (median).

If the data in increasing order is x1, x2, ..., xN and the percentile is p, then the two methods compute the data percentile value v using the following formulas:

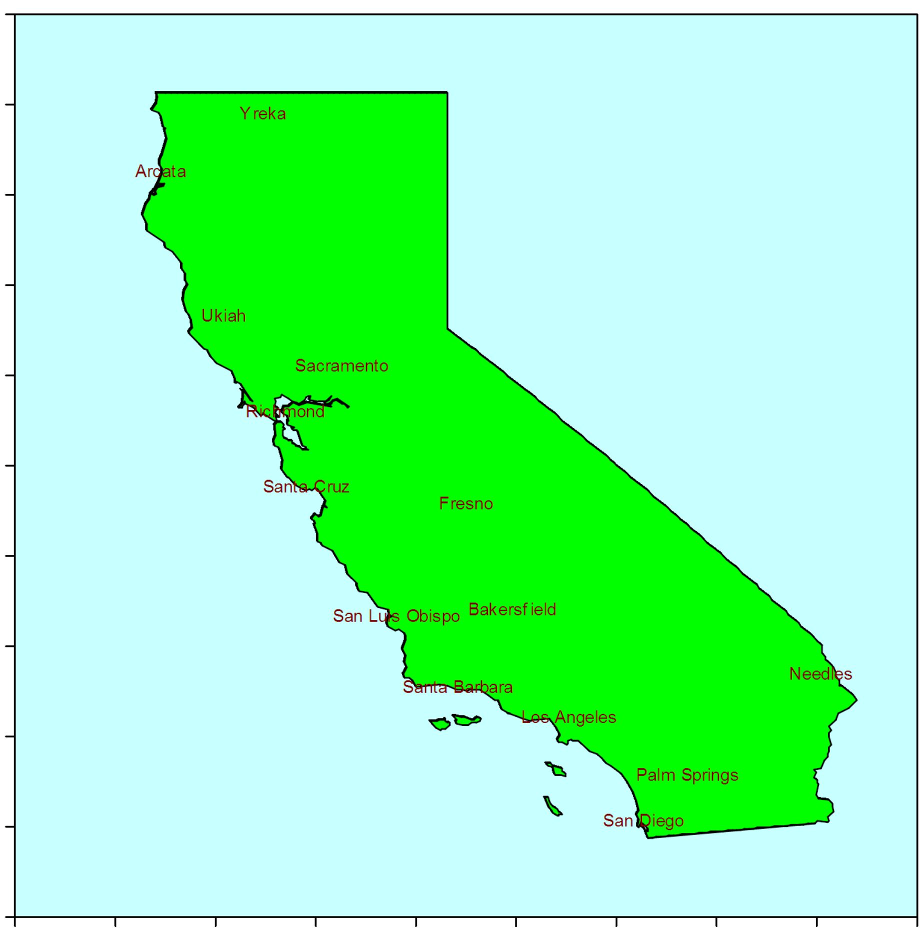
- **Cleveland:** Let k be the nearest integer to N*p/100, and let f = N*p/100 + .5 - k.
- **Standard:** Let k be the largest integer less than or equal to (N+1)*p/100, and let f = (N +1)*p/100 - k.

5. **To compute the percentile value,** each of the above methods uses the formula: v=f*xk+1+(1-f)*xk.
6. Click **OK**.

Creating Area Plots

Area plots are 2D line plots with regions below or between curves filled with a color or pattern. Most commonly, an area plot is a line plot with shading that descends to the axis. You can add shade below a curve and shade in different directions, and you can uniquely fill and identify intersecting regions.

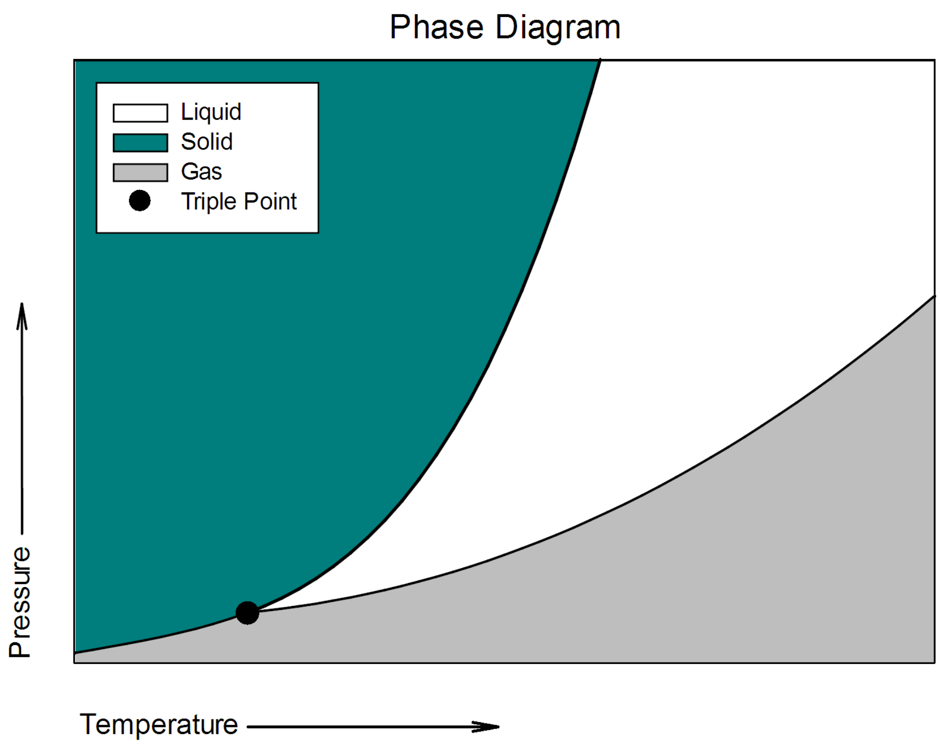
Figure 55. This example is actually four plots: a simple straight line, simple scatter, vertical area, and multiple area. You can find this example in Samples.jnb.



Creating Simple and Vertical Area Plots

Simple Area Plots plot a single line plot with a downward fill. Vertical Plots plot single YX line plots with a left direction fill.

Figure 56. In this example, there are see two vertical area plots, a simple area plot, and a simple scatter plot.



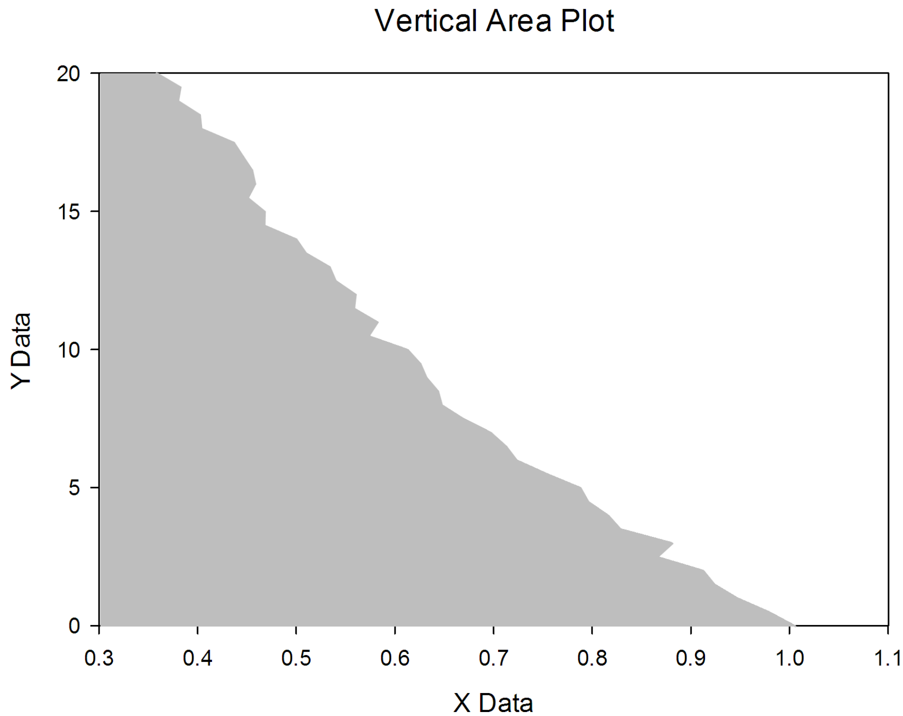
To create a simple straight line area plot:

1. Select the worksheet columns to plot by dragging the pointer over your data.
2. On the **Create Graph** tab, click **Area** in the **2DGraphs** group, and then click **Simple Area Plot**.
3. From the **Data Format** list in the **Graph Wizard**, choose the appropriate data format, and click **Next**.
   Since you already selected columns prior to opening the Graph Wizard, your choices automatically appear in the Selected Columns list.

   > **Restriction:**
   > You can plot no more than 2500 data points per curve.

4. Click **Finish** to create the graph.

Figure 57. Example of a Vertical Area Plot



Use Graph Properties to modify the plot, or reopen the Graph Wizard to pick different data columns for your plot, or to add another plot to your graph.

Creating Multiple Area and Multiple Vertical Area Plots

Multiple Area Plots plot multiple line plots with downward fills. Multiple Vertical Area Plots plot single YX line plots with left downward fills.

To create a multiple area plot:

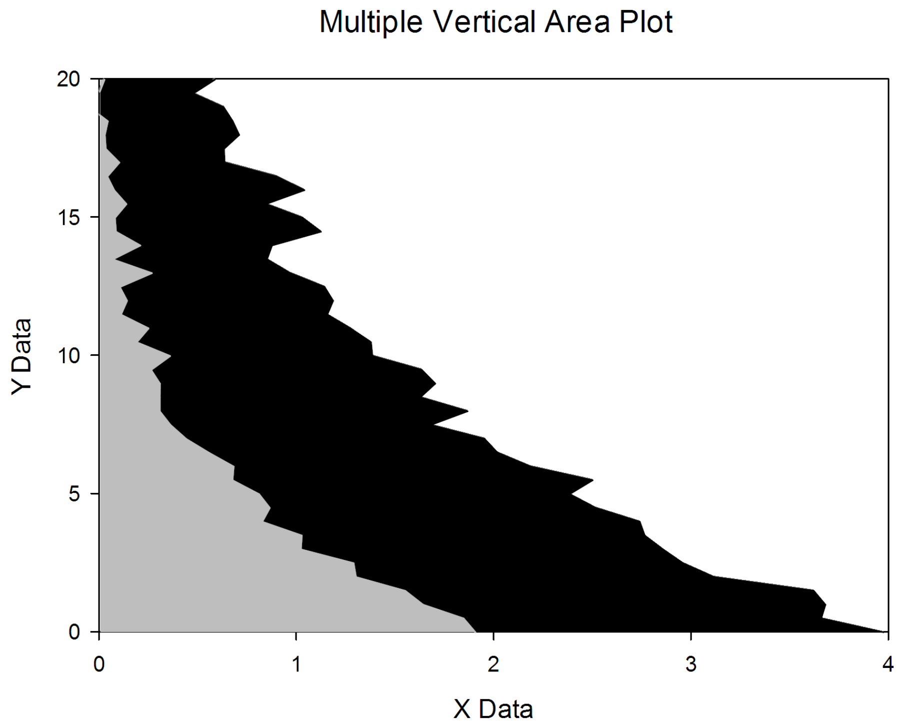
1. Select the worksheet columns to plot by dragging the pointer over your data.
2. On the **Create Graph** tab, click **Area** in the **2DGraphs** group, and then click **Multiple Area** plot.
3. From the **Data Format** list in the **Graph Wizard**, choose the appropriate data format, and click **Next**.
   Since you already selected columns prior to opening the Graph Wizard, your choices automatically appear in the **Selected Columns** list. To change the selected data, select the wrong entry in the Graph Wizard, then choose the correct column from the worksheet. You can also clear a column assignment by double-clicking it in the **Selected Columns** list.

Restriction:

You can plot no more than 2500 data points per curve.

4. Click **Finish** to create the graph.

Figure 58. Example of a Multiple Area Plot using a Y Many X data format.



Use Graph Properties to modify the plot, or reopen the Graph Wizard to pick different data columns for your plot, or to add another plot to your graph.
You can identify intersections either by using Graph Properties or by creating a complex area plot.

Creating Complex Area Plots

Complex Area Plots plot multiple line plots with downward fills and intersections.

To create a complex area plot:

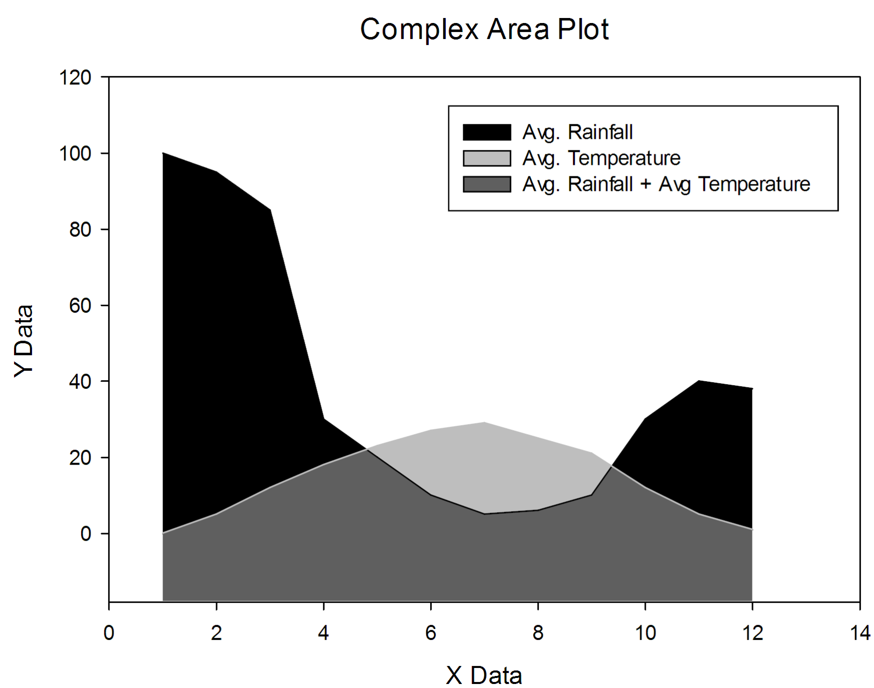
1. Select the worksheet columns to plot by dragging the pointer over your data.
2. On the **Create Graph** tab, click **Area** in the **2DGraphs** group, and then click **Complex Area Plot**. The **Graph Wizard** appears.

3. From the **Data Format** list, choose the appropriate data format, and click **Next**.
   Since you already selected columns prior to opening the Graph Wizard, your choices automatically appear in the **Selected Columns** list. To change the selected data, select the wrong entry in the Graph Wizard, then choose the correct column from the worksheet. You can also clear a column assignment by double-clicking it in the **Selected Columns** list.

> **Restriction:**
> You can plot no more than 2500 data points per curve, and you cannot plot more than four curves.

4. Click **Finish** to create the graph.

Figure 59. Intersections only appear for two or more curves, and a legend appears for each intersection.



Converting a Multiple Area Plot to a Complex Area Plot

You can uniquely identify intersecting areas of all curves of a multiple area plot with a separate fill by using the Graph Properties. Each possible intersection appears on the area plot, and each identifiable set of intersections uses the next color or pattern in the selected scheme.

You can display intersections for a minimum of two curves and a maximum of four. Plots with two curves will have up to three different regions, one region for each tuple, and one region for the intersection. Three curves yield up to seven regions, and four curves up to fifteen.

To change a multiple area plot to a complex area plot:

1.
2. If necessary, select **Plot > Area Fills** from the **Properties** list.
3. Select **Identify Intersections**.

Shading in Different Directions

Use Graph Properties to change the direction of fill colors in an area plot.

To change the area fill direction:

1. Create an area plot.
2. Double-click the plot to open **Graph Properties**.
3. Select **Plot > Area Fills** from the **Properties** list.
4. From the **Direction** drop-down list, select **Up**, **Down**, **Left**, or **Right**.

Changing Area Plot Fill Colors

Use Graph Properties to change area plot fill colors.

Restriction:
SigmaPlot only supports system patterns. If you enter patterns into the worksheet, you should only use system patterns.

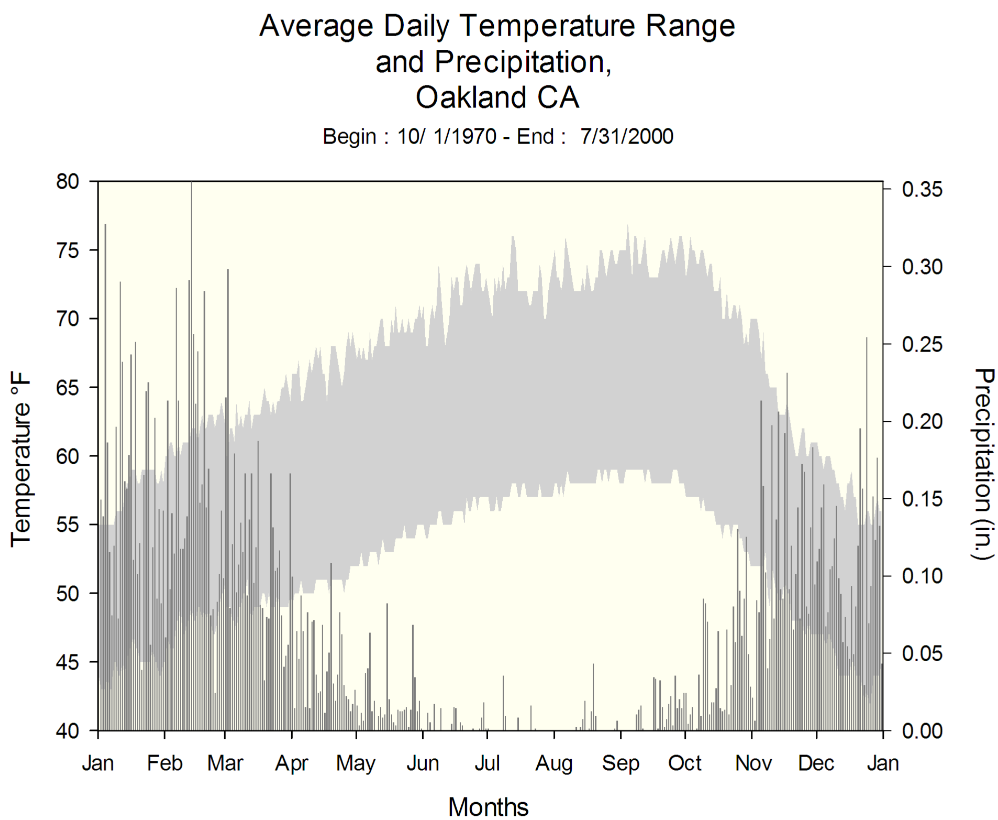
To change the area plot fill color:

1. Create an area plot.
2. Double-click the plot to open **Graph Properties**.
3. If necessary, select **Plot > Area Fills** from the **Properties** list.
4. From the **Color** drop-down list, select **(none)** to create a transparent fill color, **(Custom)** to create a custom color, or an incremental color scheme to use a color array, or any one of many available colors.
5. Select a pattern from the **Pattern** drop-down list. For more information, see Changing Patterns and Fill Colors *(on page 122)*.

Shading Between Two Curves

You can emphasize the difference between two curves by filling in the area. This is useful when creating a climograph, for example, where two lines could show high and low temperatures throughout the year. Shading between the curves aids in visualizing the range in temperatures which would otherwise be lost in a sea of data points.

Figure 60. An example of two plots, a bar chart and an area plot. In the area plot, the area between the two curves is shaded.



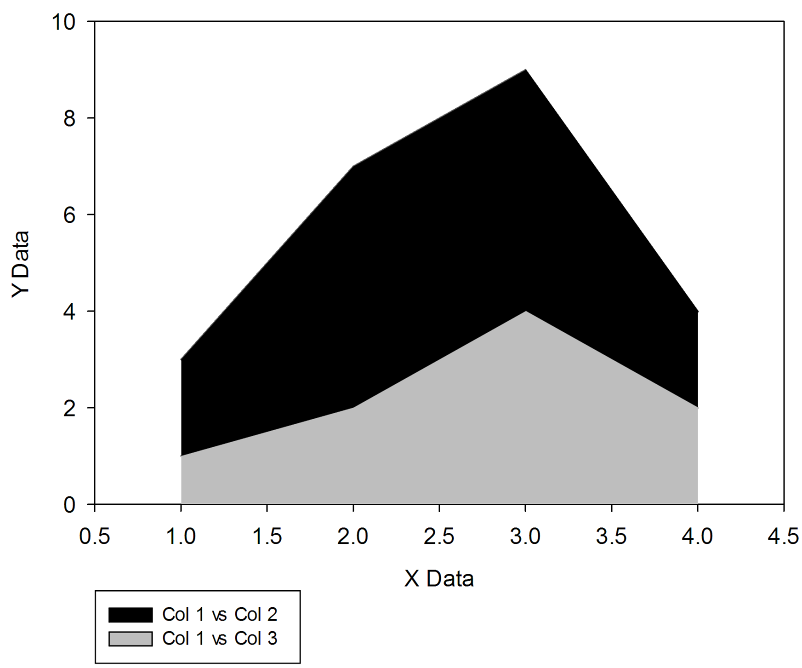
You can shade the area between two curves by:

- Using **Object Properties** to change the background color of the graph to match the lower shade.
- Using the **Insert Graphic Cells** dialog box to insert colors in to the worksheet, and then applying those to the plot.

1. To shade the area using Object Properties:

    a. Create an area plot that uses either **X Many Y** or **XY Pairs** data formats. Make sure, when in the Graph Wizard, that you first select to plot the column with the largest Y values for the upper curve. Then use the column with the smallest Y values for the lower curve.

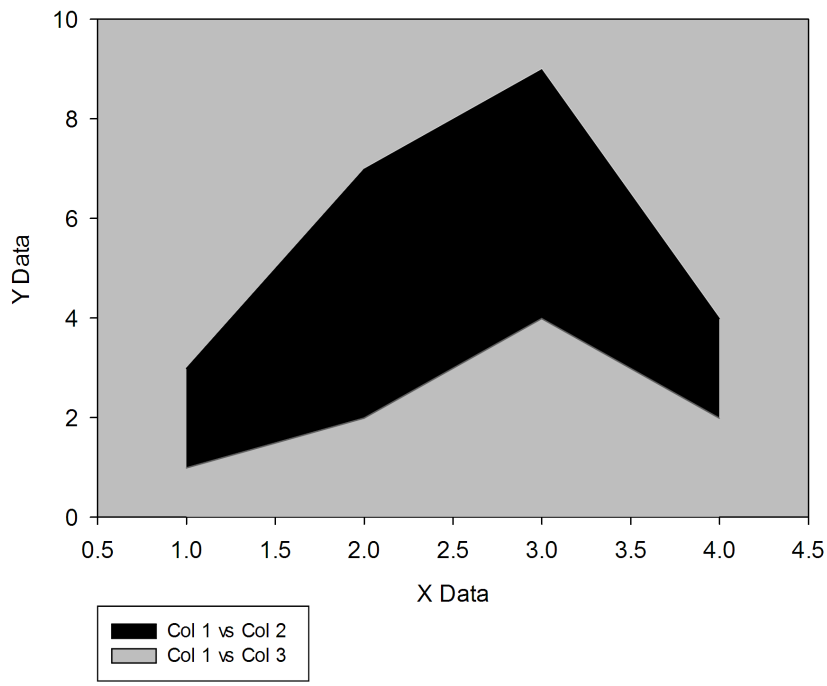
    Figure 61. To shade between the curves, first create an area plot that uses the larger values for the upper curve.

    b. Once you've created the graph, select the fill. A shortcut menu automatically appears.

    c. Click the **Paint** button, and then select the fill color that matches the color of the lower curve.
    The graph appears with the area between the two curves shaded.

Figure 62. The area between the two curves appears shaded, while the area under the lower curve matches the background.

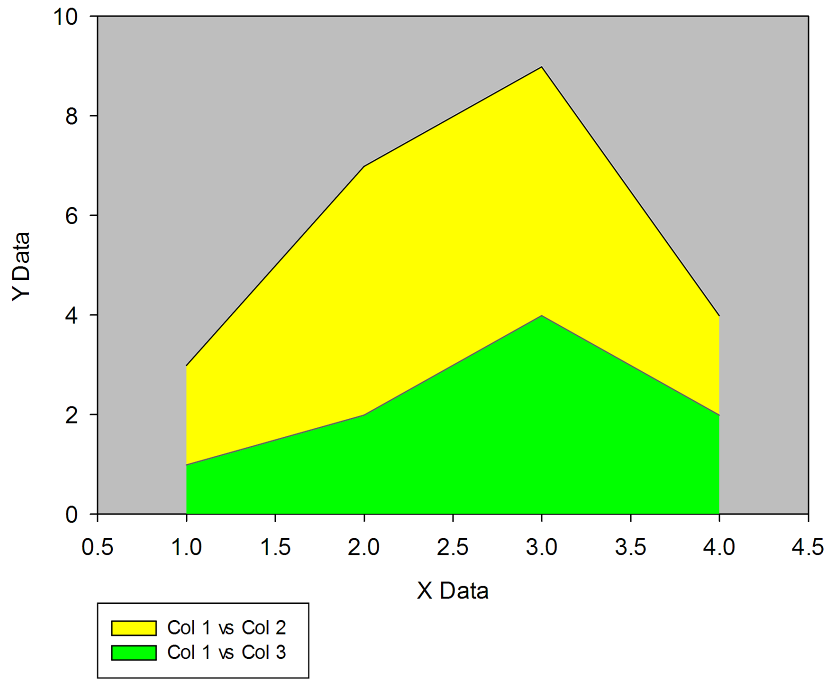


For more flexibility you can define the area colors by inserting colors into a column in the worksheet and then use the front area color as the graph background color.

2. To insert graphic cells to shade between two curves:
   a. As above, create an area plot.
   b. View the worksheet, and select a cell in the first row of an empty column.
   c. On the **Worksheet** tab, in the **Cells** group click **Graphic Cells**.
   d. In the **Insert Graphic Cells** dialog box, click the **Colors** tab.
   e. Double-click to select two colors. In the first cell (row 1), select the color that you want the area to be and in the second cell (row 2), select the color you want the background to be.
   f. Click **Close** to close the dialog box.
3. To assign the area plot colors to those in the worksheet:
   a. Double-click the graph.
   b. Select **Plot > Area Fills** from the **Properties** list.

c. Under **Fill Color,** scroll to the bottom of the **Color** drop-down list and select the column that contains the colors you selected in the **Insert Graphic Cells** dialog box.
The graph now appears with the two shaded areas filled with the colors you inserted in worksheet; however, the background of the graph is still white.

Figure 63. Once you've selected the color for the lower curve, you still must match a color for the background.

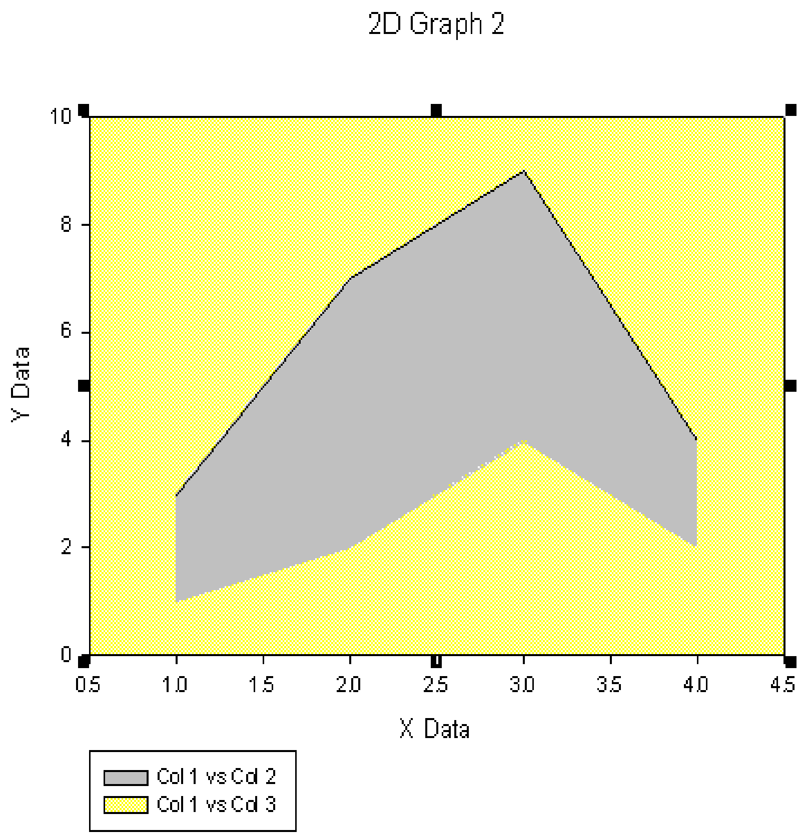


d. Now select the background fill of the graph, and in the shortcut menu, click the **Paint** button.

e. Select the color that matches the lower shaded area on the graph.

The graph appears with one shaded area between the two curves.

Figure 64. As in the example above, the graph appears with the background color matching the color of the lower shaded region.



Bubble Plots

Bubble plots are XY scatter plots that use symbols to represent not only XY locations, but also a third dimension represented by the size of the symbol. Use bubble plots to plot population density, epidemiological data, or other similar data sets where a third variable can be clearly illustrated by the size of the symbols.

Related Topics

Arranging Data for Bubble Plots *(on page 100)*

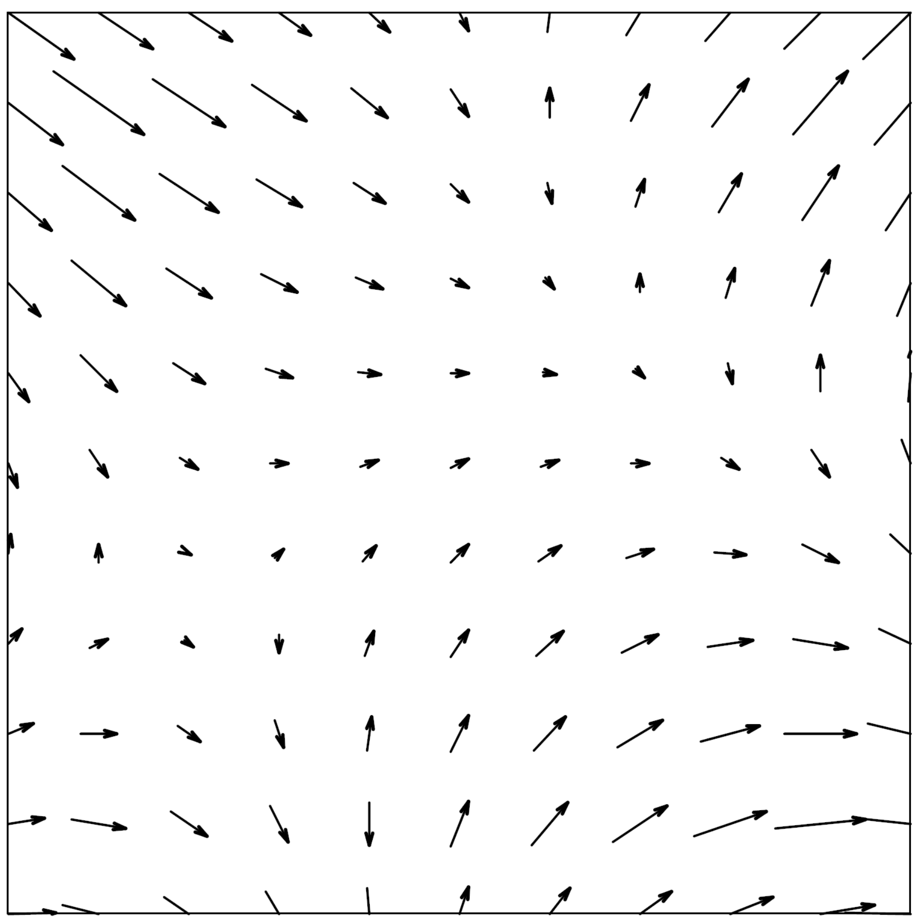
Creating a Bubble Plot

To create a bubble plot:

1. Select the worksheet columns to plot before creating your graph by dragging the pointer over your data.
2. On the **Create Graph** tab, click **Bubble** in the **2D Graphs** group.
3. When you have selected all the columns to plot, including the Bubble Size column, click **Finish**.
4. In the **Graph Wizard**, select the appropriate format from the **Data Format** list, and click **Next**.
5. When you have selected all the columns to plot, including the Bubble Size column, click **Finish**.

Vector Plots

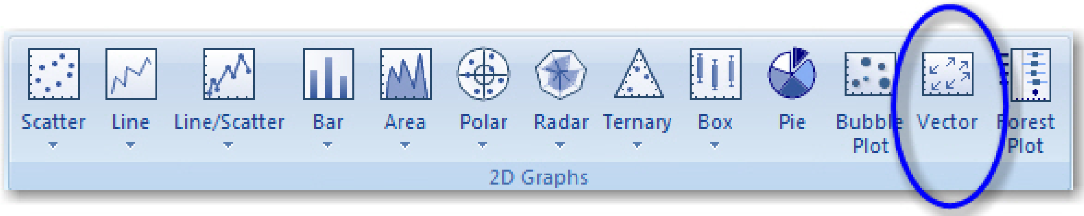
A vector plot is a line plot where the line represents the magnitude, and an arrow head represents the direction.



Creating a Vector Plot

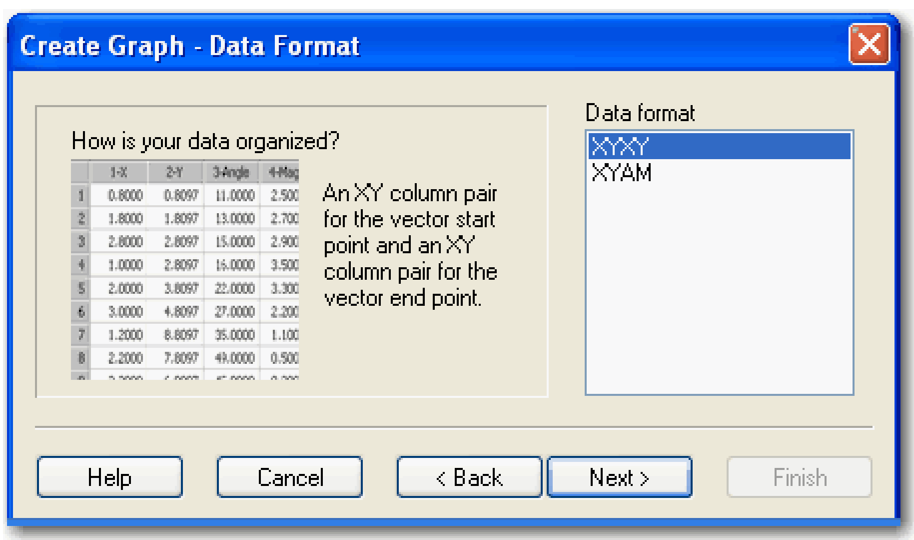
To create a vector plot:

1. Select the worksheet columns to plot before creating your graph by dragging the pointer over your data.
2. On the **Create Graphs** tab, in the **2D Graphs** group, click **Vector**.



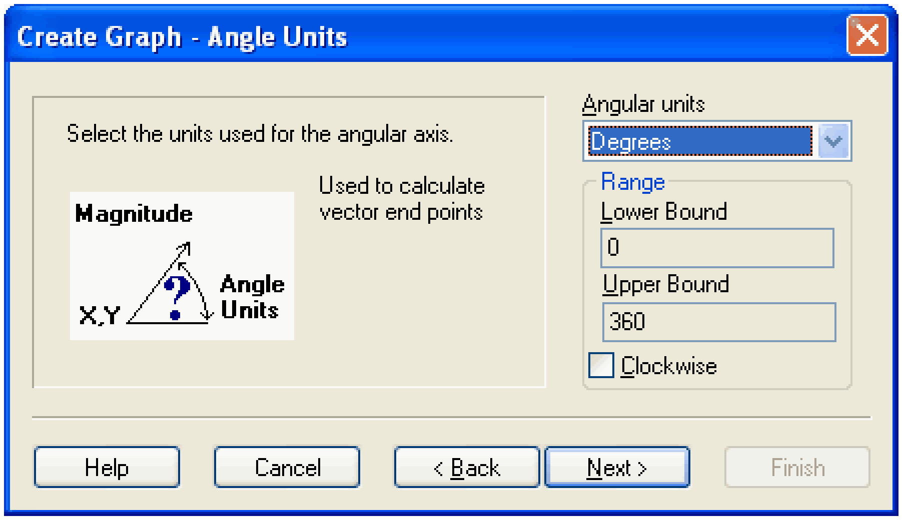
3. In the **Create Graph - Data Format** panel of the Graph Wizard, select one of the two available formats:
   - **XYXY.** Select **XYXY** when you want both Start and End points of the graph appear as XY coordinates.
   - **XYAM.** Select **XYAM** if you want the end points to be represented in terms of angle and magnitude. The XY point is the midpoint of the vector.

   Figure 65. Selecting a Vector Plot Data Format



If you select **XYAM**, when you click **Next**, the **Create Graph - Angle Units** panel appears.

Figure 66. Selecting Vector Plot Angle Units for the XYAM Data Format



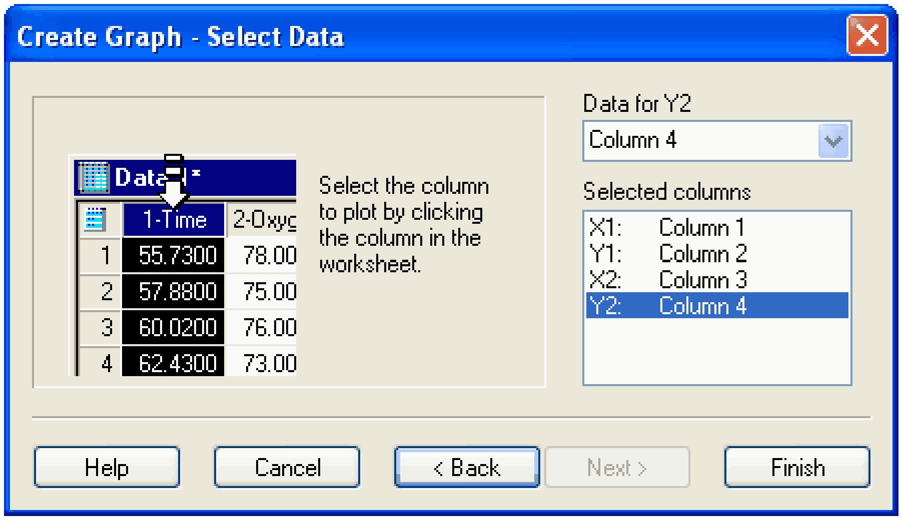
Tip:

You may need to scale the magnitude data if you are using the **XYAM** format and your vector magnitudes are either much larger or smaller than the X,Y coordinates. The vectors should be large enough to be clearly visible, but also small enough to be spaced within the X,Y coordinates so that they do not overlap.

If, for example, the magnitudes are too large, use a Quick Transform to divide the magnitude column by a constant that is roughly the ratio of the largest magnitude to the smallest X and Y coordinate increment. Then you can easily adjust this constant to obtain a pleasing graph.

4. Click **Next**. The **Create Graph - Select Data** dialog box appears.

Figure 67. Selecting Data for a Vector Plot



5. When you have selected all the columns to plot, click **Finish**.

Modifying Vector Plot Arrowheads

You can edit the degrees and length of vector plot arrowheads using the Graph Properties.

To edit the vector plot:

1. Double-click a vector on a vector plot to open **Graph Properties**.
2. Select **Plot > Vectors** from the **Properties** list.
3. Use the Line Type options to modify how vector plot lines appear in the graph.
   a. **To change the type of line, such as a dotted line or dashed,** select an option from the **Type** drop-down list.
   b. **To change the line color,** select a color from the **Color** drop-down list.
   c. **To change or add a gap color,** select a color from the **Gap Color** drop-down list. This option is only available if you select a line type with actual "gaps" in it, like dotted or dashed, for example.
   d. **To change the thickness of the line,** enter a value in the **Thickness** box.
   e. **To make the lines transparent,** move the **Transparency** slider.
4. Use the **Arrowhead** options to set arrowhead line type (lines or filled), angles in degrees, and the arrowhead lengths.

   a. **To set the arrowhead line type,** select **Lines** or **Filled** from the **Type** drop-down list.

   b. **To set the angle of the arrowhead,** move the **Angle in degrees** slider.

c. **To set the length of the arrowhead,** you can select either:
- **Percentage of vector length.** Enter a percentage into the field or move the slider.
- **Constant.** Enter a value into the field or move the slider.

Forest Plots

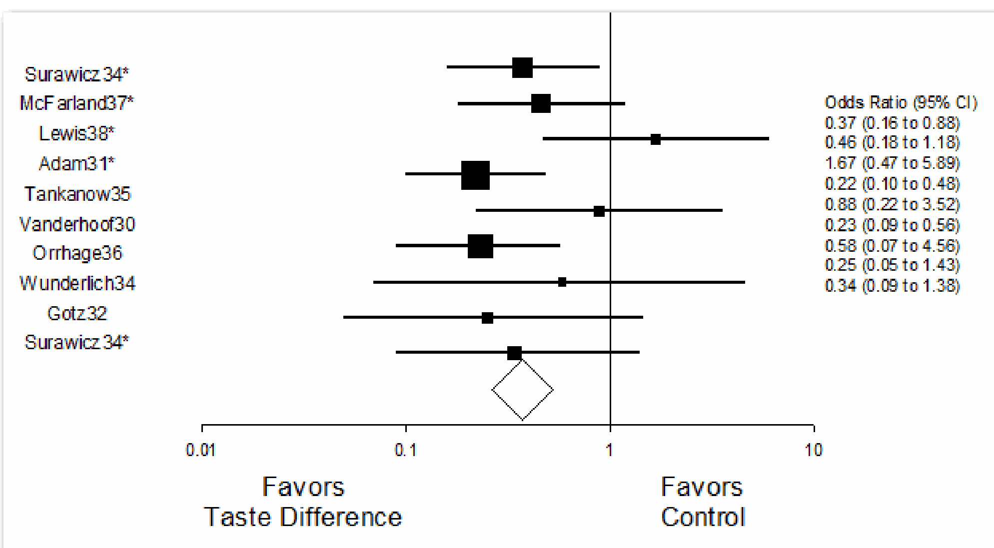
A forest plot is a type *meta-analysis*, and is used as a comparison of different experiments within a single graph. You can enter data as differences or ratios, using eight columns of data.

Meta-analysis statistically combines the samples of each contributing study to create an overall summary statistic that is more precise than the effect size in the individual studies.

Most forest plots appear with two basic parts:

- The overall effect value (diamond symbols) and its 95% confidence interval (the width of diamond).
- The individual study values (square symbols) and their 95% confidence intervals (the horizontal bars).

Figure 68. Forest plots use square symbols to show the individual study values and diamond symbols to show the overall effect value. The widths of the symbols are determined by their 95% confidence intervals.



Arranging Forest Plot Data

Forest plot data entry requires eight columns. The two forest plot data formats are:

- Differences data

Figure 69. An Example of Forest Plot Differences Data

10-Study	1-Mean Differenc	12-Lower 95% CI	13-Upper 95% CI	14-Weight	15-Overall Mean	16-Lower 95% CI	17-Upper 95% CI	18
James 1987	0.29	0.23	0.3	5	0.24	0.19	0.3	
Naylor 1987	0.28	0.22	0.34	5				
Stack 1964	0.11	0.04	0.18	5				
Stack 1967	0.27	0.2	0.33	5				
Stack 1967a	0.26	0.2	0.32	80				

- Ratios data

Figure 70. An Example of Forest Plot Ratios Data

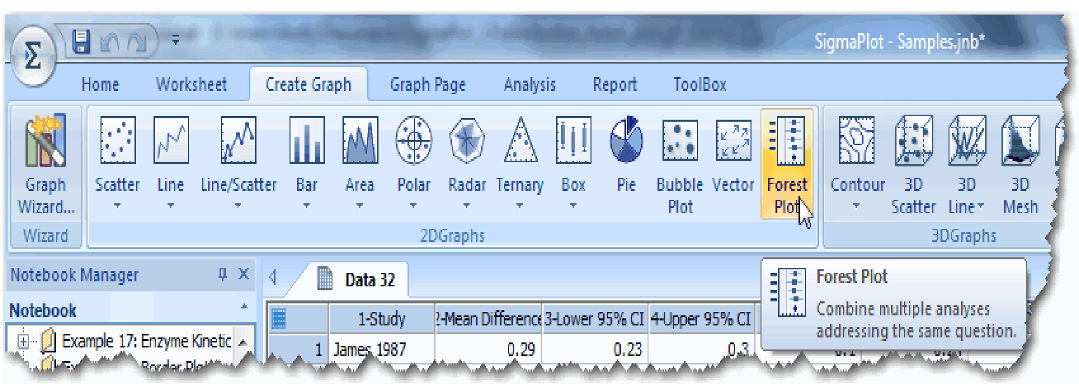
Data 32

	1-Study	2-Mean Differenc	3-Lower 95% CI	4-Upper 95% CI	5-Weight	6-Overall Mean	7-Lower 95% CI	8-Upper 95% CI
1	James 1987	0.29	0.23	0.3	0.1	0.24	0.19	0.3
2	Naylor 1987	0.28	0.22	0.34	0.05			
3	Stack 1964	0.11	0.04	0.18	0.07			
4	Stack 1967	0.27	0.2	0.33	0.05			
5	Stack 1967a	0.26	0.2	0.32	0.08			
6	Thomas 1991	0.91	0.7	1	0.5			
7	Mitchell 2001	1.02	0.8	1.2	0.2			
8	Crisp 2004	1.2	0.9	1.3	0.1			
9	Star 2006	0.8	0.6	1.1	0.15			
10	Phillips 2008	1.1	0.8	1.4	0.09			
11								
12								

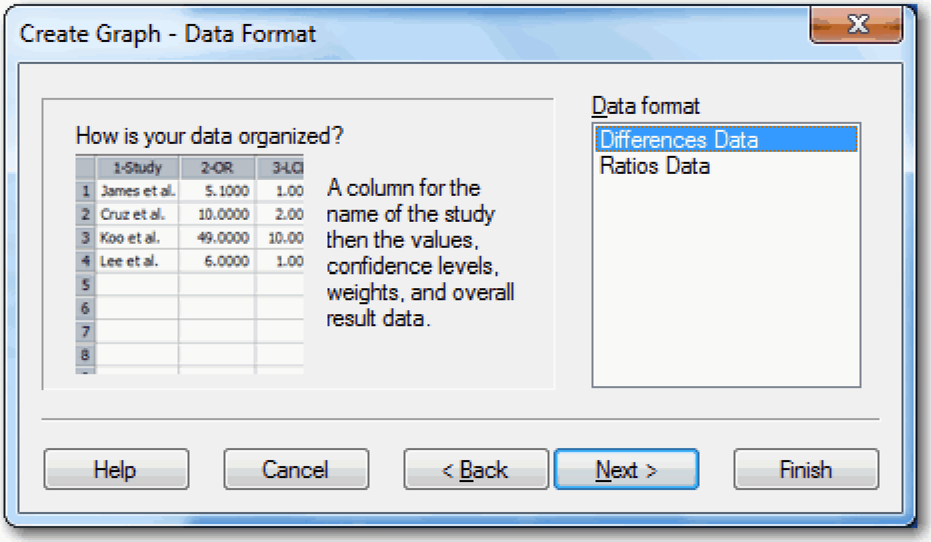
Creating a Forest Plot

To create forest plot:

1. On the **Create Graphs** tab, in the **2D Graphs** group, click **Forest Plots**.



The **Create Graph - Data Format** dialog box appears.

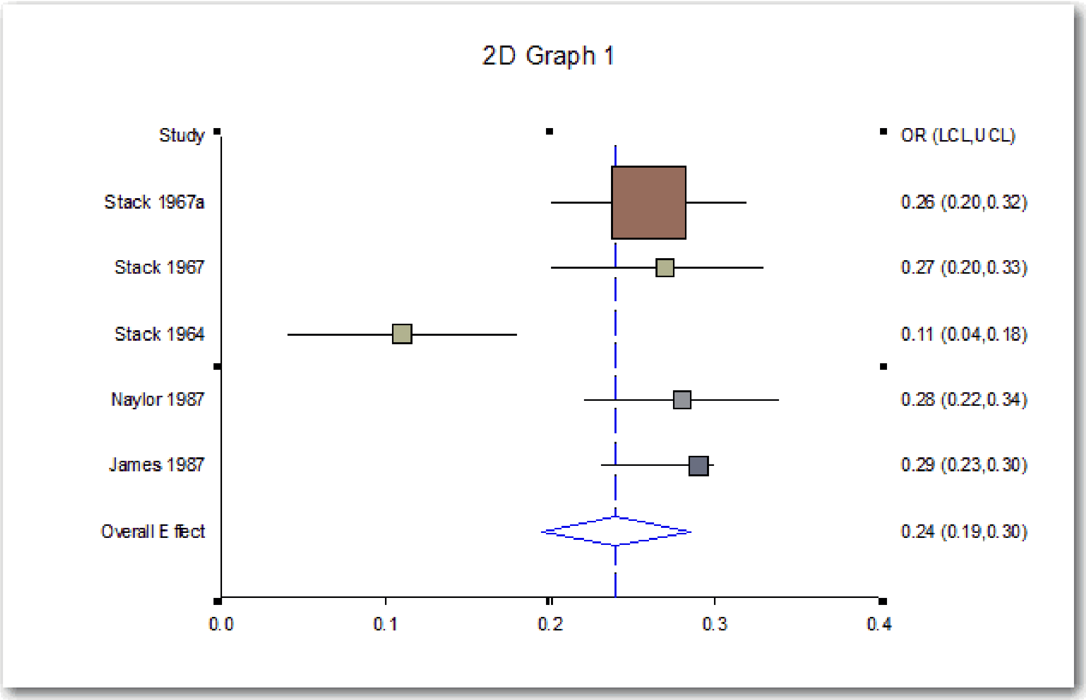


2. Select **Differences Data** or **Ratios Data**, depending on how you've entered your data. For information on entering forest plot data, see Arranging Forest Plot Data *(on page 284)*.
3. If you've correctly entered the data, then all you need to do is select all the columns. The following table shows how each column title corresponds to its proper **Selected column** name in the **Create Graph - Select Data** dialog box.

Selected Column Name	Column Title
Studies Names	Study
Studies Values	Mean Difference
Studies LCL	Lower 95% CI
Studies UCL	Upper 95% CI
Studies Weights	Weight
Overall Value	Overall Mean
Overall LCL	Lower 95% CI
Overall UCL	Upper 95% CI

4. Click **Finish**.

   A forest plot appears.



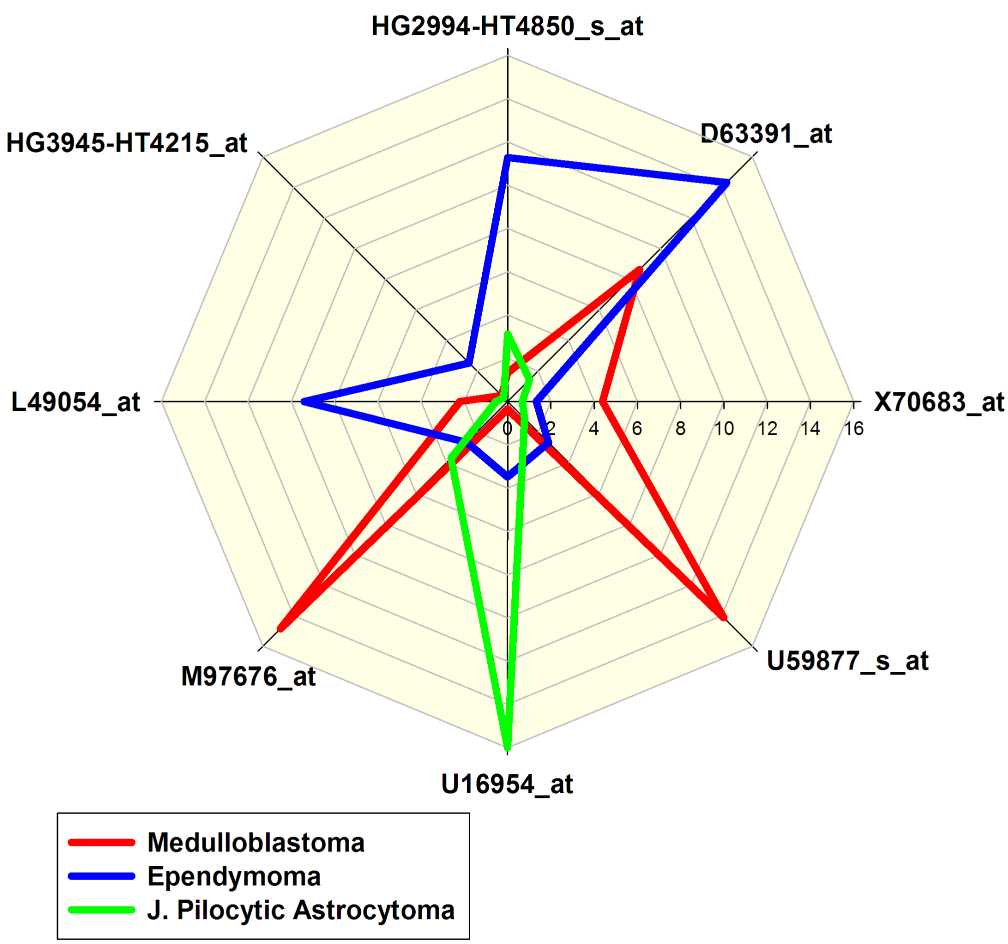
The above example of a forest plot uses the Townscape color scheme for the symbols. For more information about using incremental color schemes, see Incrementing Color Schemes *(on page 127)*.

Radar Graphs

A radar graph is a two-dimensional graph on which you can simultaneously display many variables. Each variable is plotted along a different radial line, called a spoke, emanating from the origin of the plot. If you have ten variables, there will be ten radial lines thirty-six degrees apart. In SigmaPlot, the radar plot has one axis superimposed on a spoke. The axis range defines the maximum and minimum for all variables. Small values are near the center of the radar plot, and large values are near the outer circumference. For example, an experiment might result in multiple measured variables, and you want to compare the results of this experiment but repeat it under different conditions. Connecting the variable values on each radial axis with a straight line creates a distorted star-like pattern. You can then visually compare the patterns created by the lines representing the different conditions for the experiment. The radar graph name comes from the multiple radial axes resembling a radar antenna. A radar graph is also called a spider plot, a polar plot, or a spiral space diagram.

An excellent example of using a radar graph is demonstrating the relationship between gene expression signatures and the type of childhood brain cancer. The results shown below are a radar line graph of three data sets. The results were generated using a data mining technique that determined which genes and their expression levels predicted different brain cancers. Eight genes were found to be predictive. One way to display the gene expression signature is with a radar graph. The variables for the radar graph are the gene expression levels of the eight different genes. These are shown as the eight radial axes of the following radar plot.

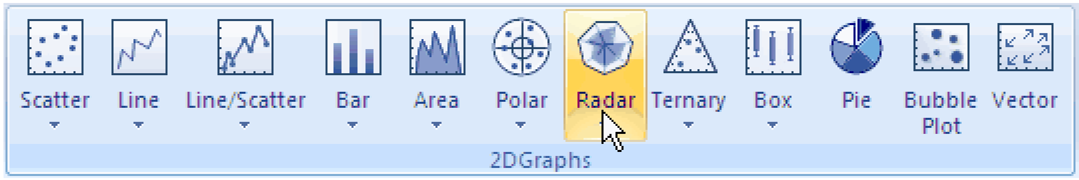
Figure 71. Example of a Radar Plot



Creating a Radar Graph

To create a radar graph:

1. Select the worksheet columns to plot before creating your graph by dragging the pointer over your data. For more information, see Radar Plots *(on page 68)*.
2. On the **Create Graphs** tab, in the **2DGraphs** group, click **Radar**.



3. Click the style of radar graph you want to create.
4. In the **Create Graph - Data Format** panel of the Graph Wizard, select one of the two available formats:
    - **Label Many Series.** Select **Label Many Series** if you want a column of data to represent labels.
    - **Many Series.** Select **Many Series** want to use at least one column as a data source.
5. Click **Next**. The **Create Graph - Select Data** dialog box appears.
6. When you have selected all the columns to plot, click **Finish**.

Working with 3D and Contour Graphs

Create 3D (XYZ) plots from many worksheet columns or column triplets.

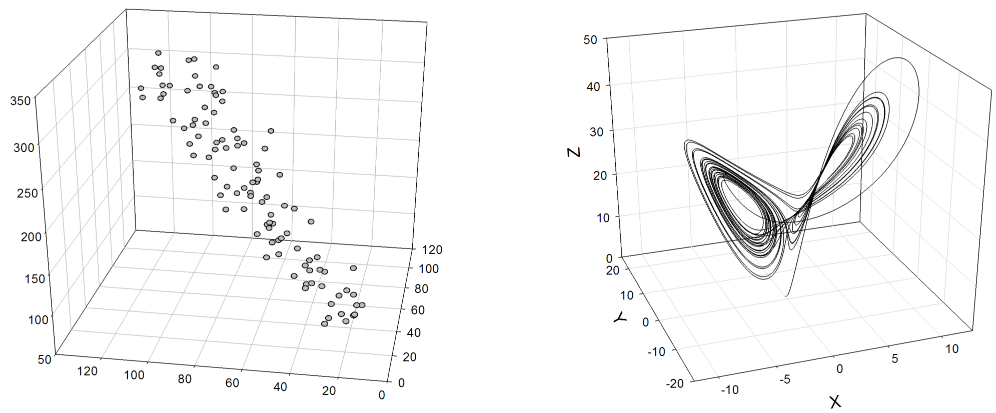
XYZ plots must have at least one plot, but can display many more plots, each with a different type and style. Graphs can be rotated and shaded added to enhance the height and depth of mesh and bar charts.

3D Scatter and Line Plots

3D scatter and Line plots graph data as symbols, as lines only with no symbols, or as symbols and lines. Use **Graph Properties** to add symbols to a 3D line plot, or the Lines settings to add lines to a scatter plot.

You can add drop lines to any back plane of either of these plot types.

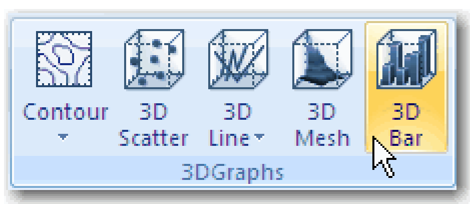
Figure 72. Examples of a 3D Scatter Plot and a 3D Line Plot



Creating a 3D Scatter Plot or 3D Bar Chart

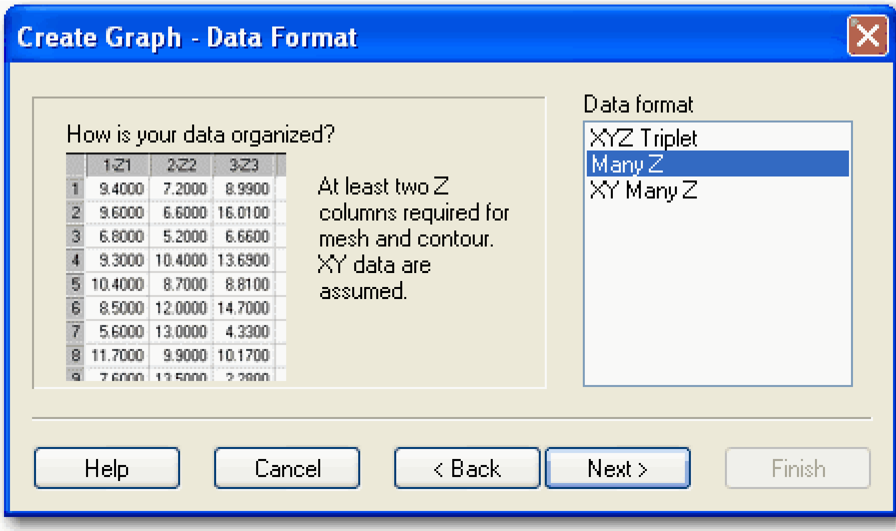
3D scatter plots can use any data format; however, 3D bar charts are limited to XY Many Z or Many Z only.

1. Select the worksheet columns to plot by dragging the pointer over your data.
2. On the **Graph** tab, in the **Create Graph** group, click **Graph Wizard**.
3. On the **Create Graph** tab, in the **3D Graphs** group, click **3D Scatter Plot** or **3D Bar Chart**.



4. In the **Data Format** list in the Graph Wizard, specify how your data is formatted. The data formats available depend on the graph type you are making.

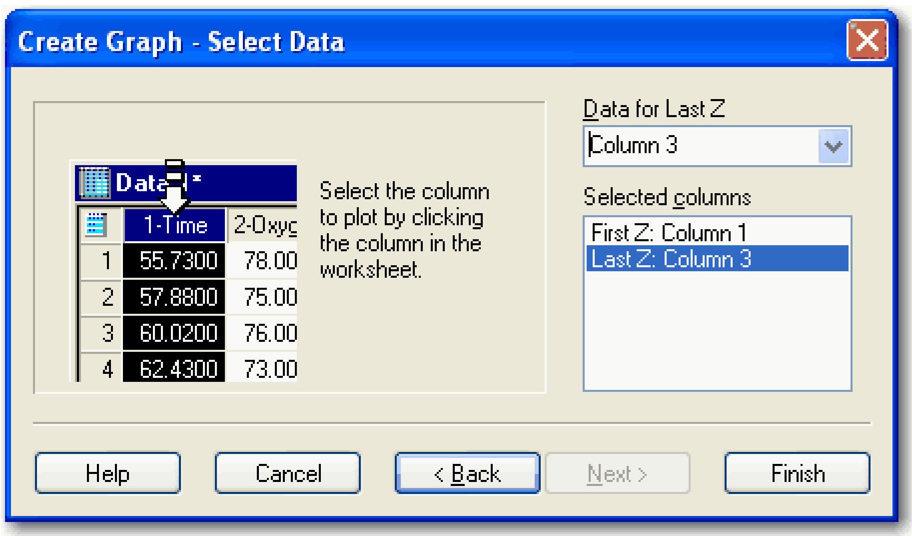
Figure 73. Specifying the Data



Form at

5. Click **Next**.

Figure 74. Selecting Columns to Plot



Since you already selected columns prior to opening the Graph Wizard, your choices automatically appear in the dialog box.

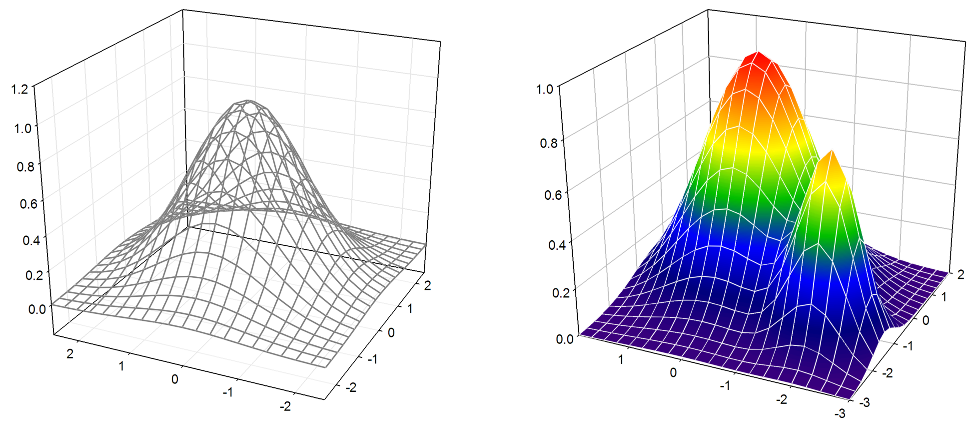
6. Click **Finish**.

Use **Graph Properties** to modify the plot, or reopen the Graph Wizard to pick different data columns for your plot, or to add another plot to your graph. For more information, see Modifying Graphs Using Graph Properties *(on page 89)*.

Mesh Plots

Mesh plots graph 3D data as a continuous surface with a mesh. Use **Graph Properties** to modify mesh lines, color, transparency, and to enable the light source for shading.

Figure 75. Mesh Plot with No Fill Color and with a Gradient of Colors

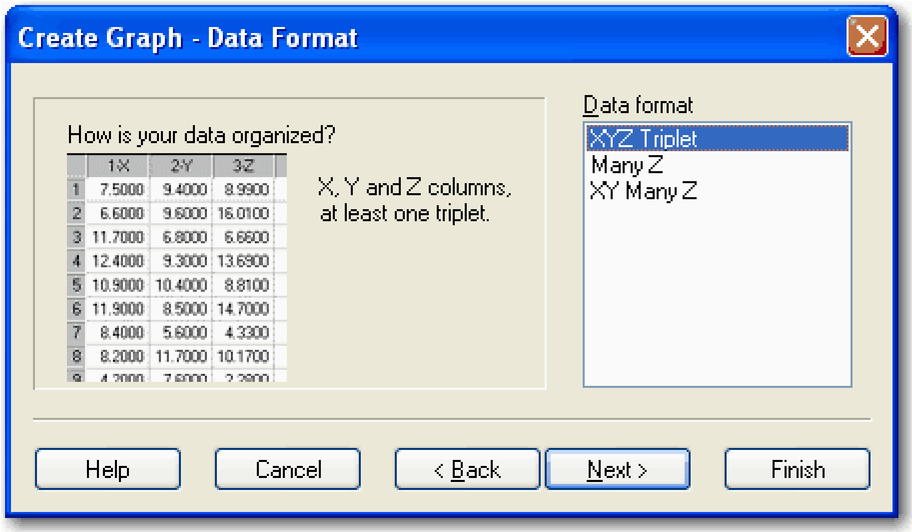


Creating a 3D Mesh Plot

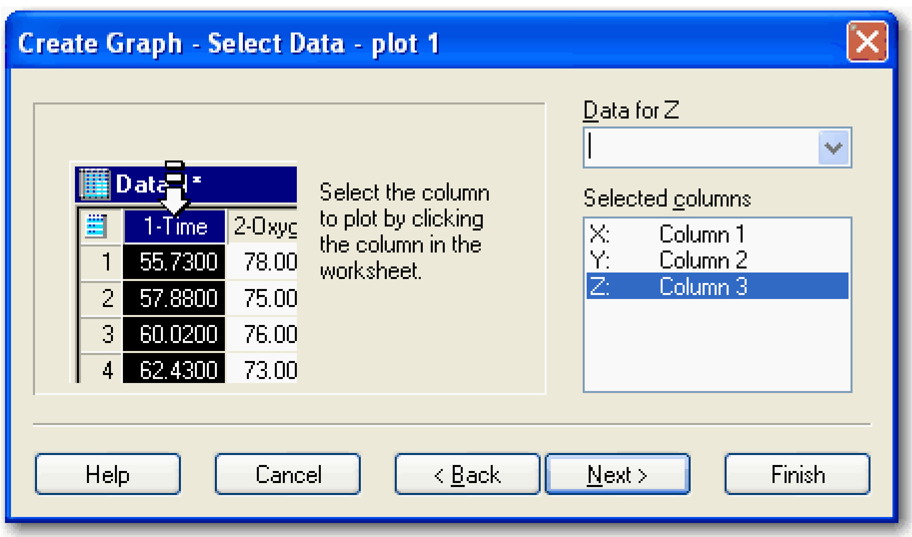
When you create a mesh plot you can choose between solid and transparent mesh with discrete or gradient shading. Use a transparent mesh to highlight the relationship of one mesh plot to another on the same graph.

3D mesh plots use an XYZ coordinate system; the data points are graphed as intersections of a mesh grid. If you select Many Z as the data format, SigmaPlot uses column numbers as the X values, and row numbers as the Y values.

1. On the **Create Graph** tab, in the **3D Graphs** group, click **3D Mesh Plot**.
2. Choose the appropriate data format from the **Data Format** list in the **Graph Wizard**.



3. Click **Next**. If you've already selected columns prior to opening the Graph Wizard, your choices automatically appear in the dialog box.



4. Click **Finish**.

   Use **Graph Properties** to modify the plot, or reopen the **Graph Wizard** to pick different data columns for your plot, or to add another plot to your graph.

Modifying Mesh Lines and Fill Color

To modify mesh lines and fill color:

1. Double-click the mesh plot to open **Graph Properties**.
2. Select **Plot > Mesh** from the **Properties** list.
3. **To change the color of the mesh,** under **Fill Colors**, select a color from the **Color** drop-down list. Select **(none)** to create a transparent mesh, select **(Custom)** to create a custom color, and select one of .the color schemes or color columns to increment the mesh from bottom to top using a color array. For more information, see Modifying Mesh Lines and Fill Color *(on page 293)*.
4. **To make your mesh translucent,** select **Transparent**. Objects behind it will be visible. Use this option to more clearly show the intersections between two or more 3D meshes.
5. **To specify how the colors flow across the grid,** from the **Transitions** drop-down list, select either **Discrete** to use an increment with a clear shift between colors, or select **Gradient** to use an increment with a gradual shift between colors.
6. **To change line thickness,** move the **Thickness** slider, or type a new value in the **Thickness** box.

Changing Graph Perspective, Rotation, and Shading

Modify the view of the 3D graph by changing perspective and rotation of the graph, and by enabling a light source to add shading.

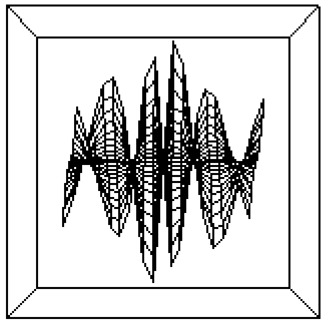
1. Double-click the plot to open **Graph Properties**.
2. Select **Graph > Rotation** from the **Properties** list.
3. **To rotate the graph,** move the **Horizontal** and **Vertical View** sliders, or type horizontal or vertical values into the boxes.

> **Note:**
> Horizontal and vertical values are in degrees. Rotate the graph horizontally from 0° to 360°, or vertically from -90° to +90°. The recommended **Horizontal View** is 205°, and the **Vertical View** is 25°. The rotation is displayed in the axes degrees from 0°. The origin used to determine the degree from the horizontal or vertical is the intersection of the three axes.

When both rotation angles are set to 0°, the origin as you see the graph, is the left bottom rear corner.

> **Tip:**
> The origin axes are not related to the axes marked with ticks and tick labels, but act as the zero point for tick labels and data.

Figure 76. A 3D graph with a horizontal rotation of 0°, a vertical rotation of 0°, and a perspective of 20



4. **To change the perspective of the graph,** move the **Perspective** slider, or type a new value into **Perspective** box.

Figure 77. A 3D graph with a horizontal rotation of 0°, a vertical rotation of 45°, and a perspective of 20

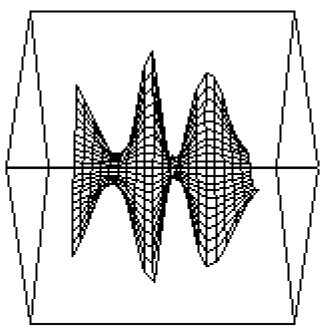


Figure 78. A 3D graph with a horizontal rotation of 45°, a vertical rotation of 45°, and a perspective of 20

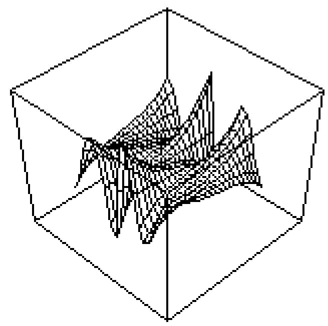
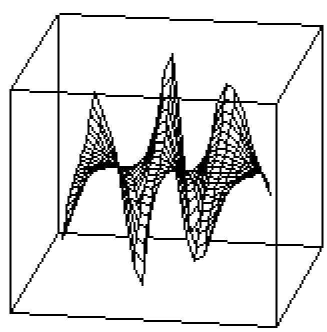


Figure 79. A 3D graph with a perspective of 0



Note:
The Perspective value is based on the depth of the graph. A perspective of 0% means that the graph has no depth; 100% means that the graph has maximum depth. The recommended perspective is 20%.

Figure 80. A 3D graph with a perspective of 50

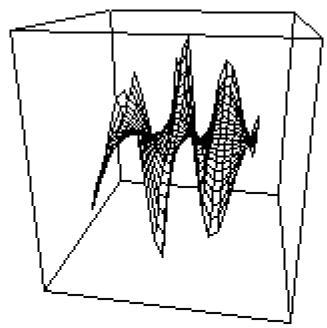
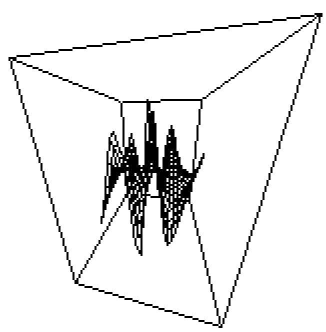


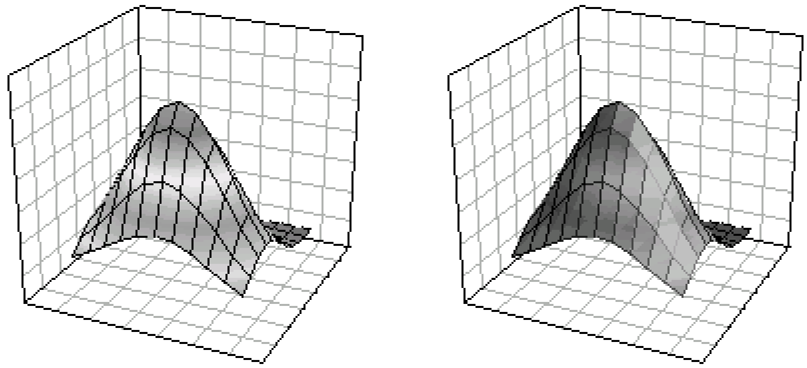
Figure 81. A 3D graph with a perspective of 100



5. **To turn on the light source and create shading on your graph,** select **Enable Light Source**. If this option is cleared, the light source is not applied to the graph.

> **Attention:**
> Set your display to **High Color (16 bit)** or **True Color (24 bit)** for this feature to work properly. You may check your system's color capabilities under the Windows Display Properties Settings.

Figure 82. The graph on the right has the light source option selected.



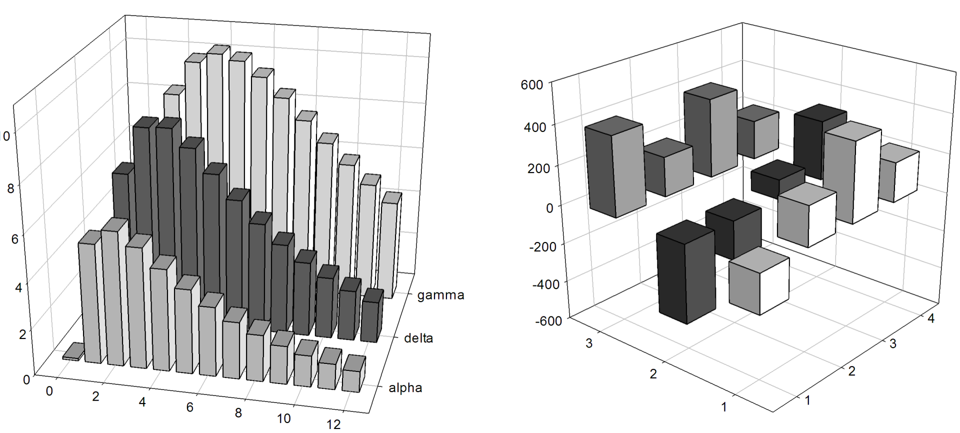
3D line and scatter plots are not affected by the light source option.

6. **To return to the 3D View settings you had before applying any changes,** click **Reset to last applied**.

3D Bar Charts

Create bar charts in 3D space using 3D data. Modify 3D bar charts by changing fill color and pattern. For more information, see Changing Patterns and Fill Colors *(on page 122)*. You can also adjust bar width and spacing.

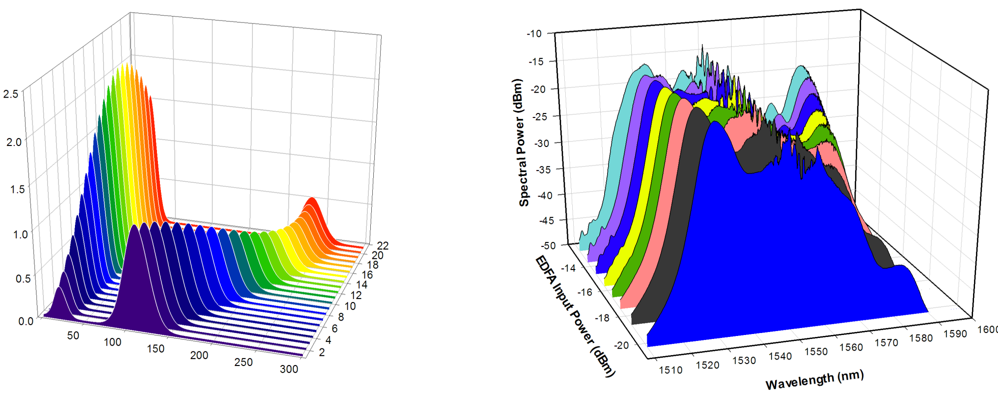
Figure 83. 3D Bar Charts



Waterfall Plots

Waterfall plots graph 3D data as stacked line plots along the Y axis. Use **Graph Properties** to modify plot lines, color, and transparency.

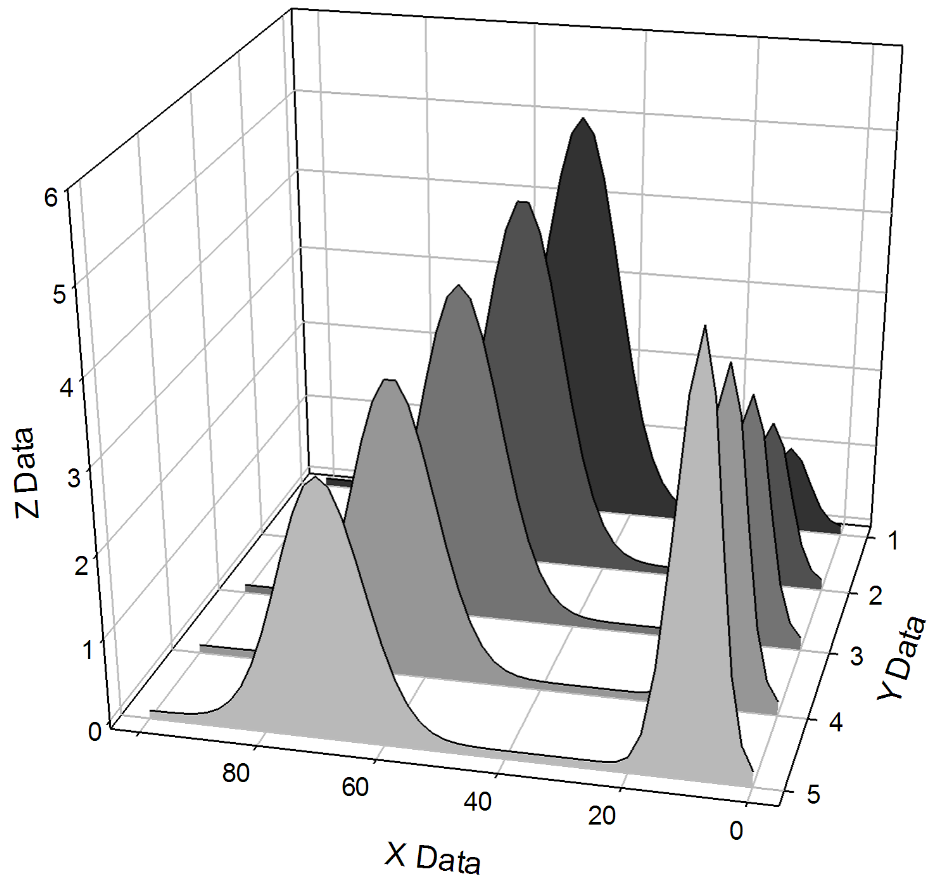
Figure 84. Waterfall Plots



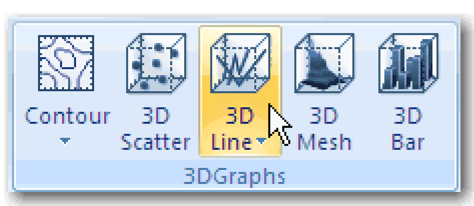
Creating a Waterfall Plot

3D waterfall plots are stacked line plots along the Y axis. Because hidden lines are eliminated, waterfall plots are useful for showing trends of line plots.

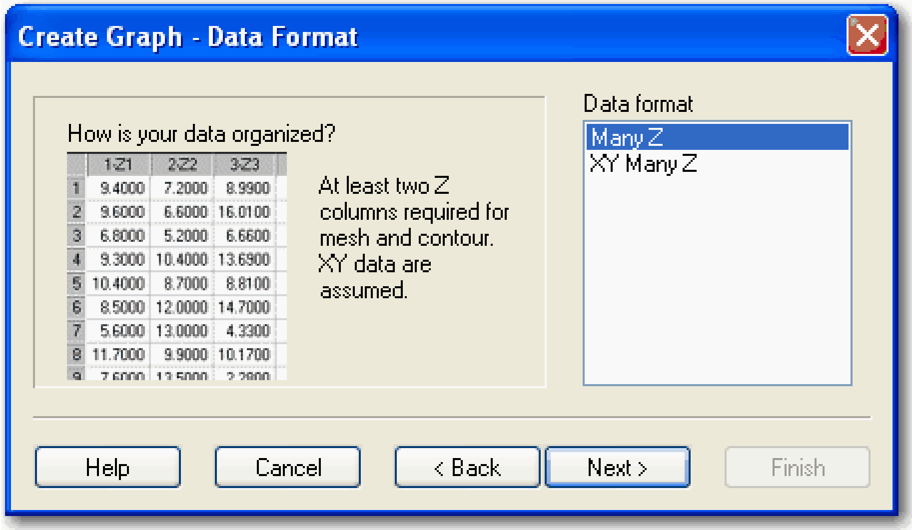
3D waterfall plots are limited to Many Z and XY Many Z data formats.



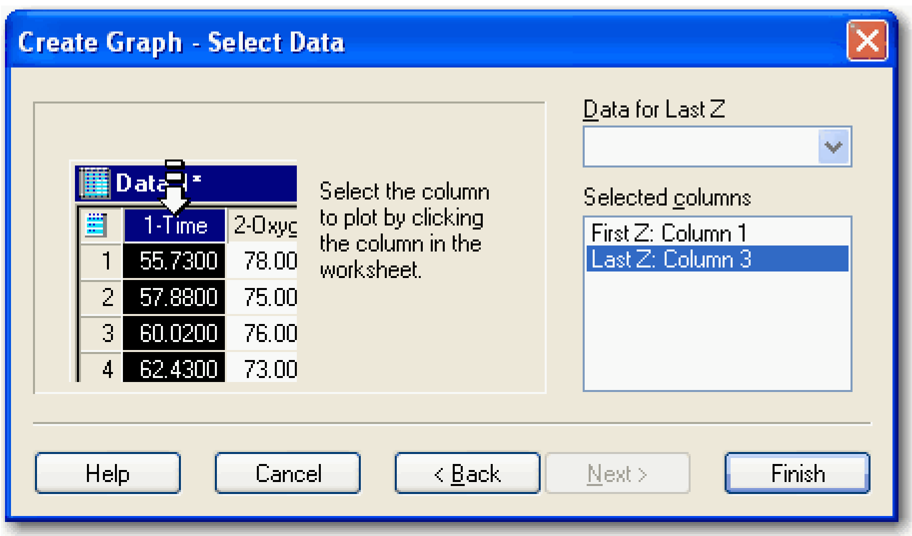
1. Select the worksheet columns to plot by dragging the pointer over your data.
2. On **Create Graph** tab, in the **3DGraphs** group, click **3D Line Plot**.



3. Click **3D Waterfall**.
4. From the **Data Format** list, choose the appropriate data format.



5. Click **Next**. Since you've already selected columns prior to opening the Graph Wizard, your choices automatically appear in the **Selected Columns** list.



6. Click **Finish**.

   Use the **Graph Properties** to modify plot lines, color, and transparency.

Changing the Color of Drop Planes in Waterfall Plots

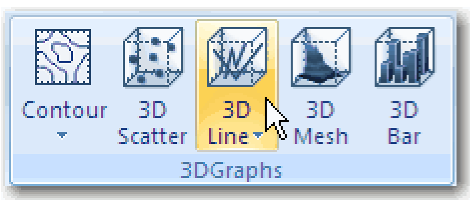
You can change color scheme within the drop planes of waterfall plots, as well as add a drop plane to 3D scatter and 3D line plots, using Graph Properties.

1. In the waterfall plot (or 3D scatter or line plot), double-click a plane to open **Graph Properties**.
2. Select **Plot > 3D Lines** from the **Properties** list.
3. **To set the color of the graph plane,** under **Fill color**, select a color from the **Color** drop-down list.
4. **To set a color scheme for the planes,** select **Scheme** from the **Color Schemes** drop-down list and then a particular color scheme to color the waterfall plot planes.
5. **To create a transparent fill,** select **Transparent**. When a fill is transparent, it becomes translucent; that is, other plots are visible even if when they appear "behind" the plot.

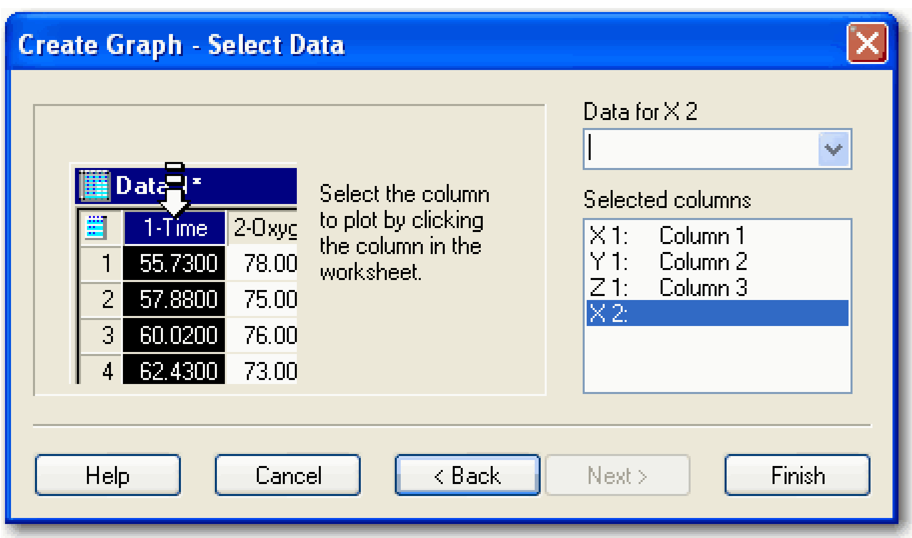
Creating a Trajectory Plot

Trajectory plots use an XYZ coordinate system to create a 3D line plot.

1. Select the worksheet columns to plot by dragging the pointer over your data.
2. On the **Create Graph** tab, in the **3D Graphs** group, click **3D Line Plot** .



3. Click **3D Trajectory**. If you already selected columns prior to opening the Graph Wizard, your choices automatically appear in the **Selected Columns** list.



4. Click **Finish**.

   Use the **Graph Properties** to modify the plot, or reopen the **Graph Wizard** to pick different data columns for your plot, or to add another plot to your graph. For more information, see Creating and Modifying Graphs *(on page 52)*.

3D Graph Axis Placement

3D axes are always at the following positions (unless you rotate the graph horizontally):

- X: bottom right front
- Y: bottom left front
- Z: left front

Axis Placement During Graph Rotation

When you rotate the view of a 3D graph, SigmaPlot automatically repositions the visible axes to the front of the graph so that the axes do not become positioned behind the graph.

Drawing, Modifying, and Hiding Frame Lines

Drawing a 3D graph frame completes the cube surrounding the plotted data. Normally, these lines are hidden. You can use a frame to mark the origin axes, or to mark the 3D extent of the graph.

Frame lines are unrelated to the lines used to draw axes and planes, and are controlled independently of those lines. Frame lines are drawn over the axes.

To add frame lines, modify frame lines, or hide frame lines from view:

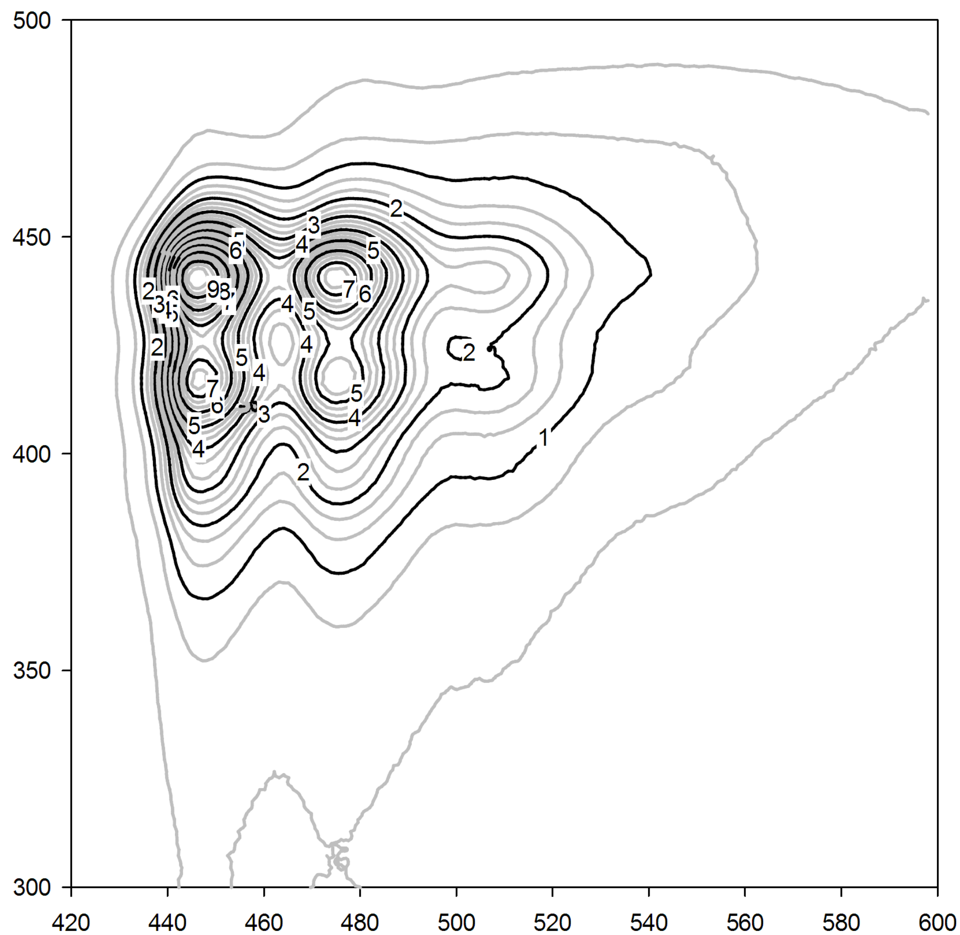
1. Double-click the plot to open **Graph Properties**.
2. Select **Graph > Frame Lines** from the **Properties** list.
3. From the **Frame Lines** drop-down list, select either:
   - **Relative to Viewer:** If the frame is oriented from your perspective, one set of lines is composed of the three cube edges closest to you, and the other lines are the remaining sides of the cube. The position of these lines is independent of the graph's rotation. This is the default position.
   - **Relative to Graph Origin:** If the frame is drawn according to the origin, one set of the lines is drawn over the origin axes, and the other lines draw the remainder of the cube. The position of these lines is dependent on the graph's rotation.

4. Hide frame lines, or add frame lines to your graph by selecting or clearing the appropriate **Show** check box. Selected frame lines are drawn.
   A graph cannot display frame lines for both the **Relative To Viewer** and **Relative To Graph Origin** perspectives. If **Relative To Graph Origin** is selected from the **Frame Lines** drop-down list, the **Show** check boxes for **Relative To Viewer** are cleared automatically, and vice versa.
5. **To change the frame line type,** under **Front** lines, from the **Line Type** drop-down list, select a line type.
6. **To change a frame line color,** under **Front Lines**, from the **Color** drop-down list, select a frame line color.
7. **To create transparent frame lines,** select **(none)** from either list. Choose **(Custom)** from the **Color** drop-down list to use or create a custom color.
8. **To the modify frame line thickness,** move the **Thickness** slider, or type a new thickness value into the thickness field.

Creating Contour Plots

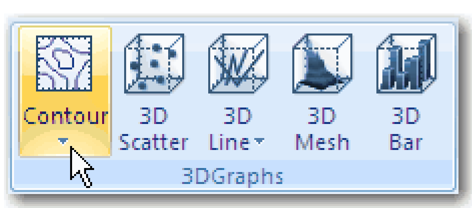
Contour graphs and filled contour graphs plot 3D data on an XYZ coordinate system with the Z data (vertical) indicated with lines at specified Z intervals. If you select Many Z as the data format, SigmaPlot uses column numbers as the X values, and row numbers as the Y values. If you are using XYZ triplet data, it needs to be reformatted as mesh data.

Figure 85. Contour Plots



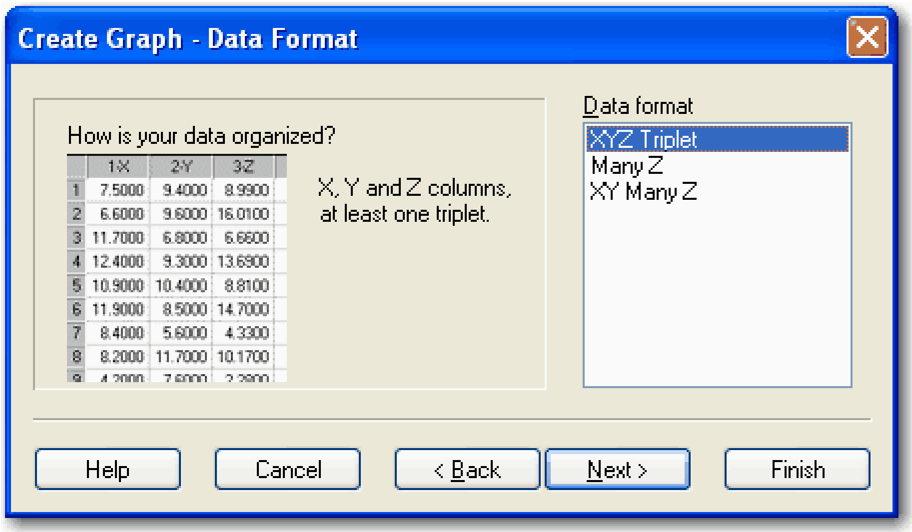
Creating a Contour Plot

1. Select the worksheet columns to plot by dragging the pointer over your data.
2. On the **Create Graph** tab, in the **3D Graphs** group, click **Contour Plot**.



3. Click **Contour**.

4. In the **Graph Wizard**, from the **Data Format** list, select the appropriate data format, and click **Next**. The **Graph Wizard** prompts you to specify which worksheet columns correspond to the data for your plot. Since you selected columns prior to opening the Graph Wizard, your choices automatically appear in the **Selected Columns** list.

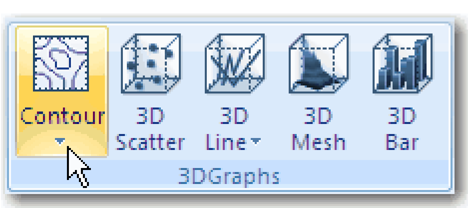


> **Tip:**
> If you made a mistake picking data, click the wrong entry in the **Selected Columns** list, then select the correct column from the worksheet. You can also clear a column assignment by double-clicking it in the **Selected Columns** list.

5. Click **Finish**.

Creating a Filled Contour Plot

1. Select the worksheet columns to plot by dragging the pointer over your data.
2. On the **Create Graph** tab, in the **3DGraphs** group, click **Contour Plot**.



3. Click **Filled Contour**.

4. In the **Graph Wizard**, from the **Data Format** list, select the appropriate data format and click **Next**. The **Graph Wizard** prompts you to specify which worksheet columns correspond to the data for your plot. Since you selected columns prior to opening the **Graph Wizard**, your choices automatically appear in the **Selected Columns** list.
5. Click **Finish**.

Modifying Contour Plots

Use **Graph Properties** to modify a contour plot. You can:

- Pick new data for the plot.
- Change contour line attributes, and hide or display lines.
- Modify back plane color and grid lines.
- Change the vertical (Z data) range and scale.
- Change X and Y axis and tick attributes.
- Add colors to contour fills.
- Turn on or off interpolated fills.
- Change and display contour labels.

Displaying and Changing Contour Lines

To modify contour lines:

1. Double-click the plot to open **Graph Properties**.
2. Select **Plot > Contour Fills** from the **Properties** list.
3. **To modify contour lines,** from the **Contours** drop-down list, select **Major** or **Minor**. The Line Styles reflect the contour you select in the **Contour** drop-down list. Select **Major** to change the **Line Styles** for major contours. Select **Minor** to change the **Line Styles** for minor contours.
4. **To specify the line type of major and minor contour lines,** select a line type from the **Line Type** drop-down list. Select one of the incrementing schemes to increment contour line types, or select **(none)** to create transparent lines.
5. **To select the color of the contour lines,** from the **Line Style Color** drop-down list, select a color. You can choose from several predefined color schemes, or select **(none)** to create transparent lines. Select **(Custom)** to create a custom color.
6. **To set the thickness of the contour lines,** select the value in the **Thickness** box and type a new value.

Adding Fills to Contour Plots

To fill intervals between contour lines with colors:

1. Double-click the plot to open **Graph Properties**.
2. Select **Plot > Contour Fills** from the **Properties** list.
3. Select **Major** from the **Contours** drop-down list.
4. In the **Color** drop-down list, under **Fill**, select from several predefined color schemes.
5. Set the direction of the contour fills from the **Start** drop-down list. The default direction is bottom. That is, the fill starts from the lowest z value.

Modifying Interpolated Filled Contours

When you create a filled contour plot from the toolbar, its fill colors are automatically interpolated and stretched to fit the number of z-intervals.

To turn off interpolated fills:

1. Double-click the plot to open **Graph Properties**.
2. Select **Minor** from the **Contours** drop-down list.
3. Under **Fill**, select **(none)** from the **Color** drop-down list.

Changing Contour Vertical (Z Data) Range and Scale

Use Graph Properties to select the scale type and set the vertical range used by the contour lines.

To set the scale and range used by contour lines:

1. Double-click the plot to open **Graph Properties**.
2. Select **Plot > Contour Scale** from the **Properties** list.
3. From the **Scale Type** list, select **Linear** or **Log (Common)** scale. The linear scale uses a standard base 10 numeric scale, and the log scale uses a base 10 logarithmic scale.
4. **To manually set the Z axis range,** enter beginning and ending range values in the **Start** and **End** boxes.
5. **To automatically set the Z axis range,** select **Data Range** from the **Calculation** drop-down lists. SigmaPlot automatically determines the vertical range based on the Z data plotted.
6. **To add padding to both ends of the axis,** select **Pad 5%**.
7. **To extend the range to the nearest major tick mark,** select **Nearest Tick**.

Changing Contour Line Intervals

Use the Graph Properties Line Interval settings to select line intervals for Major and Minor contours.

To set line intervals for major contour lines:

1. Double-click the plot to open **Graph Properties**.
2. Select **Plot > Contour Scale** from the **Properties** list.
3. Select the **Major** or **Minor** lines to modify from the **Apply to** drop-down list.
4. Under **Line intervals**, select one of the following intervals from the **Lines** drop-down list:
    - **Automatic:** SigmaPlot automatically determines the interval at which contour lines are drawn.
    - **Manually:** Manually set the number of contour lines are drawn. Enter the z interval in the **Every** box, and the value at which the first interval is drawn in the **From** box.
    - **Columns:** Select the column used to determine major contour line z values.

> **Note:**
> When major contour lines are plotted from a column, no minor lines are drawn.

Displaying and Modifying Contour Labels

Use the Graph Properties Label settings to switch contour line labels on and off, add prefixes or suffixes to labels, and rotate labels relative to the contour line.

To add, hide or modify contour line labels:

1. Double-click the plot to open **Graph Properties**.
2. If not already visible, select **Plot > Labels** from the **Properties** list.
3. **To display or hide contour labels,** under **Contour Labels**, select or clear **Major Contour Labels** and **Minor Contour Labels**.
   Selected options display labels, and cleared options hide labels.
4. **To align contour labels parallel to the contour line,** under **Label Appearance**, select **Align With Contour Line**.
   Clear the option to align the contour labels parallel to the X axis.
5. **To control how many labels appear for the contour lines,** move the **Label Frequency** slider.
   Move the slider toward **Fewer** to reduce the number of contour labels, or move the slider toward **More** to increase the number of contour labels.

6. **To add to the contour labels,** under **Add to Major Labels** and **Add to Minor Labels**, in the **Prefix** and **Suffix** boxes, type the prefix or suffix.
7. **To separate a suffix or prefix from the tick label,** type a space before a suffix or after a prefix.

Changing Contour Label Settings

Using the Graph Properties you can:

- Use a numeric type of contour label.
- Use a series type of contour label.
- Use values or text from a worksheet column for contour labels.
- Change the font size, style or color of contour text labels.

Setting a Numeric Type of Contour Label

1. Double-click the plot to open **Graph Properties**.
2. If not already selected in the **Properties** list, select **Plot > Contour Details**.
3. From the **use** drop-down list, specify which type of numeric display to use.
   The Scientific Notation and Engineering Notation options always use scientific notation or engineering notation to display numbers.
   - **For large numbers options,** use scientific or engineering notation only when numbers exceed a specified range. Use the **Above** and **Below** lists to specify the range beyond which scientific notation or engineering notation is used.
   - **For linear scale,** you can always use scientific notation, or only when needed. If you use scientific notation only when needed, set the range to by typing values in the **Lower** and **Upper** ranges in the edit boxes. These values are expressed in log units.
4. Use the **Precision** options to specify the number of places used to display numeric tick labels. Select **Automatic** to let SigmaPlot automatically determine precision, or select **Manual**, then select the number of decimal places to use from the **Places** drop-down list.

Setting a Series Type of Contour Label

1. Double-click the plot to open **Graph Properties**.
2. Select **Plot > Contour Details**
3. From the **Type** drop-down list, select **Series**.
4. From the **Series** list, select one of the following series:
   - Months
   - Days of the week

    - Years
    - Alpha Series
    - Numeric
5. From the **Length** drop-down list, select the number of characters to use for the labels.
6. From the **Start At** drop-down list, select the series item to begin labeling tick marks with, then from the **Step By** drop-down list, select the frequency or increment for the series.
7. **To restart tick labeling from a specified point,** use the **After** and **Repeat From** drop-down lists.

Using Values or Text from a Worksheet Column for Contour Labels

1. Enter the values or text in a worksheet column.
2. Double-click the plot to open **Graph Properties**.
3. Select **Plot > Contour Labels** from the **Properties** list.
4. From the **Type** drop-down list, select the column containing tick labels.

Changing the Font Size, Style or Color of Contour Text Labels

Changing the text attributes for both major and minor contour labels involves changing the font, style, size and color of the text.

1. Double-click the plot to open **Graph Properties**.
2. Select **Plot > Contour Details** from the **Properties** list.
3. Click **Contour label font** to open **Text Properties**.

Working with Pie Charts, Polar, and Ternary Plots

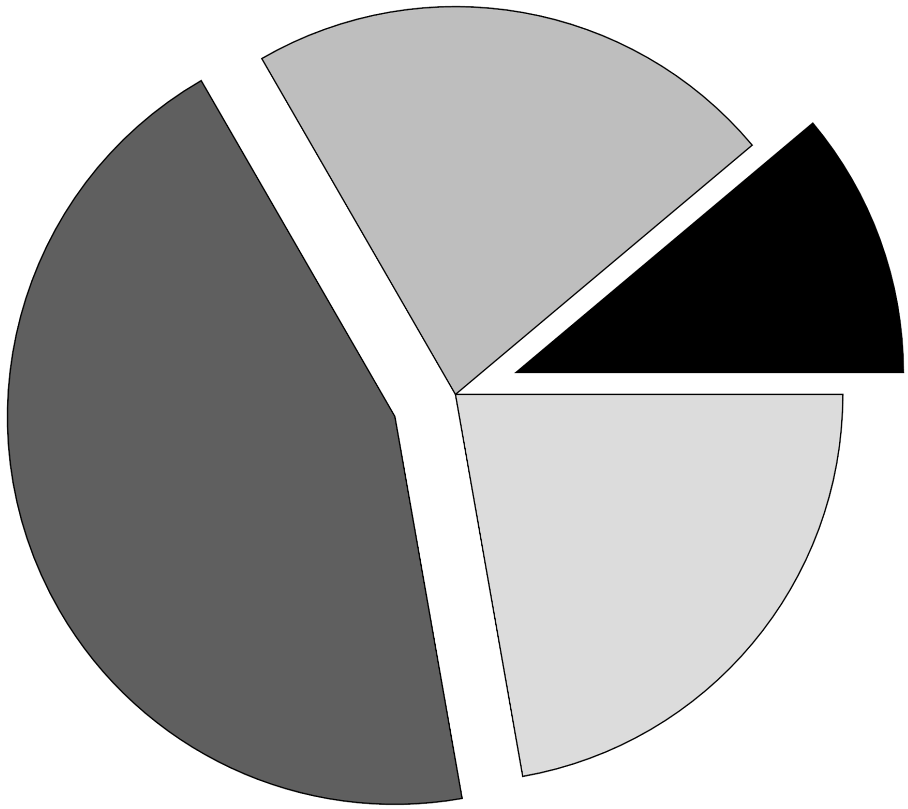
This section describes basic procedures specific to pie charts, polar plots, and ternary plots.

To learn more about making general graph modifications, like changing symbols, lines, or fills, see Creating and Modifying Graphs *(on page 52)*

Pie Charts

Pie charts plot a single worksheet column by representing each data point in the column as a pie slice. Each data point in the column is graphed as a slice size equivalent to the data point's percent of the sum of all the data.

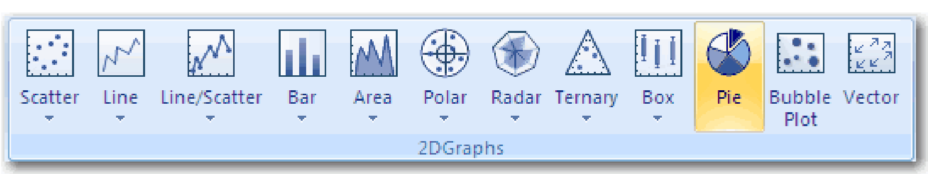
Figure 86. Example of a Pie Chart



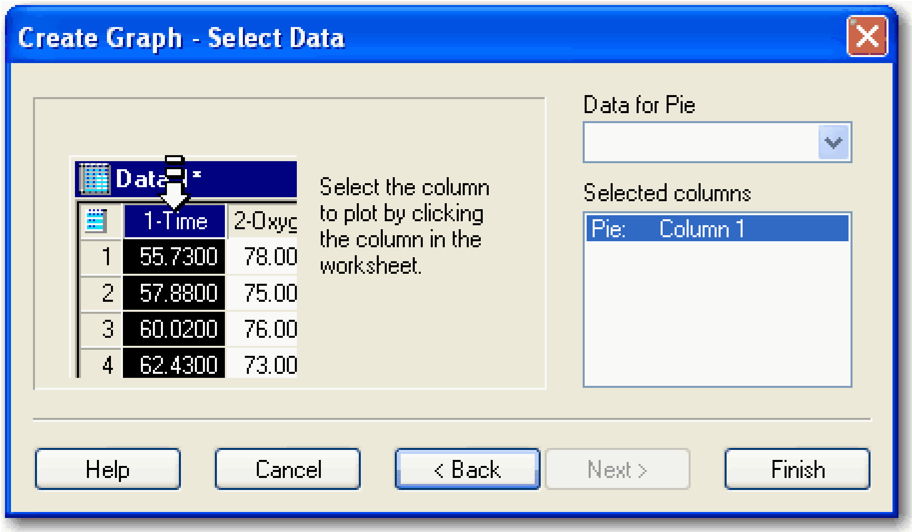
The first pie slice starts at 0 degrees (3 o'clock) by default. Additional slices are added counterclockwise, in the order the data points occur in the column.

Creating a Pie Chart

1. Select worksheet data before creating the graph.
2. On the **Create Graph** tab, in the **2DGraphs** group, click **Pie**.



3. Specify which worksheet column corresponds to data for your plot. Since you selected a column prior to opening the Graph Wizard, your choice automatically appears in the dialog box and you can click **Finish** to create the pie chart.



4. If you selected the incorrect columns to plot, select a column either by clicking the corresponding column directly in the worksheet, or selecting the appropriate column from the **Data for Pie** list.

> **Tip:**
> If you make a mistake while picking data, click the wrong entry in the Graph Wizard, then select the correct column from the worksheet.

5. Click **OK**.
6. Use **Graph Properties** to modify the pie chart, or reopen the Graph Wizard to pick a different data column for your plot.

> **Restriction:**
> You cannot add plots or axes to pie charts.

Modifying Pie Charts

Modifying pie charts includes:

- Changing fill color and patterns of pie chart slices.
- Rotating the pie chart.
- Adding exploded pie slices to the pie chart.
- Picking new data for the graph.

To modify a pie chart, select the graph and modify it using **Graph Properties**. For more information, see Creating and Modifying Graphs *(on page 52)*.

Rotating the Pie

Use **Graph Properties** to rotate pie charts or add single or multiple exploding slices.

To rotate the pie:

1. Double-click select the pie chart to open **Graph Properties.**
2. Select **Plot > Pie Slices** from the **Properties** list.
3. Under **First slice starts**, move the **Counterclockwise at** slider to change the starting angle. Increasing the starting angle for the first slice moves the starting slice counterclockwise. The default is 0° (3 o'clock).

Adding Exploding Slices

Use **Graph Properties** to add single or multiple exploding slices.

To explode one slice:

1. Double-click select the pie chart to open **Graph Properties.**
2. Select **Plot > Pie Slices** from the **Properties** list.
3. Select **Single Slice** from the **Explode** drop-down list.
4. Select the number of the slice to explode from the **Exploded slice** drop-down list.
   By default, the first slice begins at 0° and proceeds counterclockwise. If you have not rotated the pie chart, the slice number corresponds to the worksheet row number.

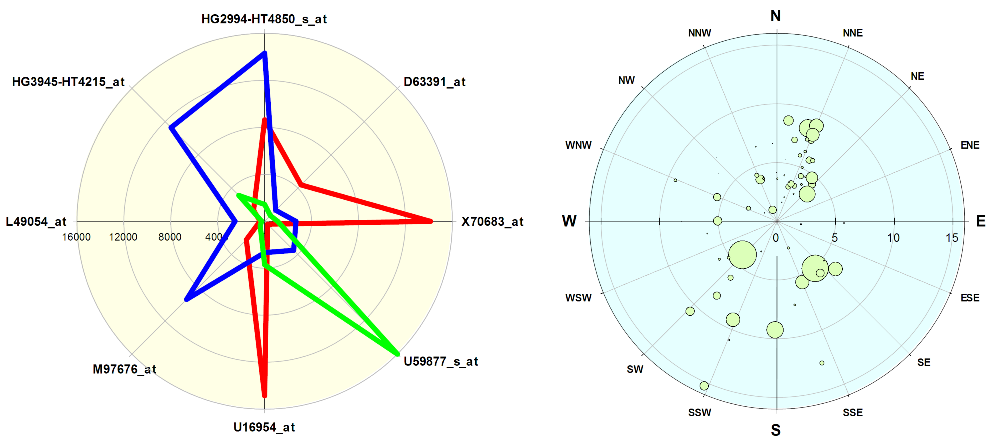
> **Tip:**
> Choosing **No exploded slices** from the **Explode** drop-down lists replaces any exploded pie slices.

Polar Plots

Polar plots display data in the coordinate system format where *r* is the distance from the origin of the graph, and theta (θ) is the angle between the positive horizontal axis and the radius vector extending from the origin to the plotted data point.

Use polar plots to show data where one value (θ) is periodic in nature, like a clock. An example of this is a graph that shows average temperatures of differing geographical regions during the days of a month, or months of a year.

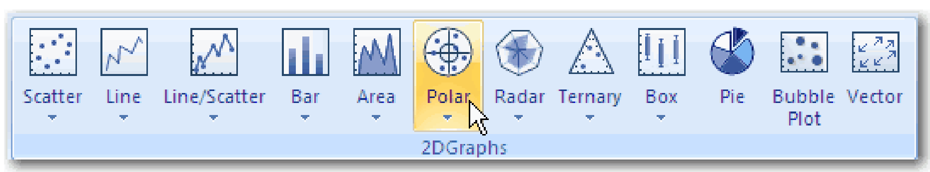
Figure 87. Polar Plots



Ternary Graphs *(on page 316)*

Creating a Polar Plot

1. Select the worksheet columns to plot by dragging the pointer over your data.
2. On the **Create Graph** tab, in the **2DGraphs** group, click **Polar Plot**.



3. Click the style of polar plot you want to create.
4. In the **Graph Wizard**, choose a unit type from the **Angular units** drop-down list. The **Range Lower Bound** and **Range Upper Bound** boxes change depending on your selection from the list.

> **Tip:**
> If you don't see the axis units you want to use for your polar plot listed in the list, you can type the desired values in the **Range Lower Bound** and **Range Upper Bound** fields.

5. If you want to create a polar plot with its angles increased in a clockwise direction, select **Clockwise**. This creates a plot where the **Range Lower Bound** starts at the top of the graph. On a counter clockwise polar plot, the **Range Lower Bound** starts at the 3 o'clock position.

6. Click **Next**.
7. Select the appropriate data format from the **Data format** list.
8. Click **Finish**.

   Use **Graph Properties** to modify the plot, or reopen the **Graph Wizard** to pick different data columns for your plot. For more information, see Creating and Modifying Graphs *(on page 52)*.

Modifying a Polar Plot

Modifying polar plots involves:

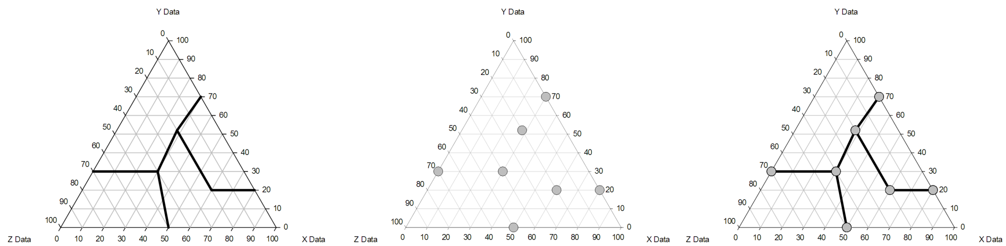
- Modifying angular and radial axes. For more information, see Modifying Polar Axes *(on page 346)*.
- Picking new data for the plot. For more information, see Picking Different Data for the Current Plot *(on page 83)*.
- Changing symbol type, size, and color. For more information, see Changing Symbol Type and Other Symbol Options *(on page 94)*.
- Changing line type, size, and color. For more information, see Changing Line Type and Other Line Options *(on page 117)*.
- Modifying back plane color and grid lines. For more information, see Displaying Grid Lines and Backplanes *(on page 344)*.

To modify a polar plot, select the graph and modify it using Graph Properties. For more information, see Modifying Graphs Using Graph Properties *(on page 89)*.

Ternary Graphs

Ternary graphs plot data on an XYZ coordinate system in the form of three variables that add up to 100% or 1. These variables are typically the normalized proportions of three substances and are plotted on three axes generally arranged as an equilateral triangle, known as a composition triangle. These graphs are also commonly referred to as triangle plots.

Figure 88. Examples of a Ternary Line Plot, Scatter Plot and Scatter and Line Plot



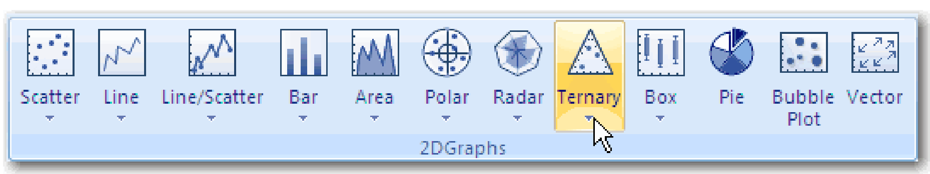
Ternary Plot Styles

You can create ternary scatter, line, and scatter and line plots. These graph data as symbols, as lines only with no symbols, or as symbols and lines, respectively. Line shapes can be straight segments or spline.

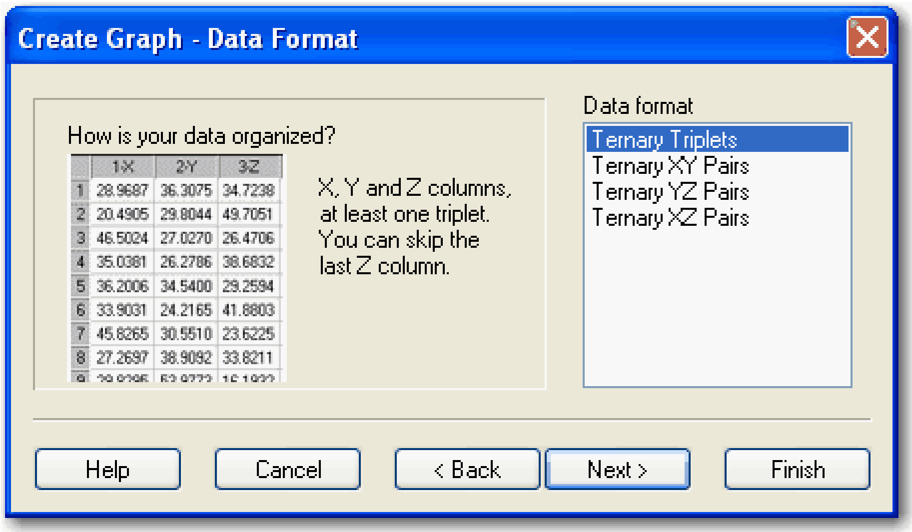
Creating a Ternary Plot

Ternary plot data set (triplet or pair) must be based on a percentage or unitary scale with the sum of all values being 100% or 1. If your data does not add up to 100% or 1, you must first normalize the data.

1. Drag the pointer over your data to select the worksheet columns to plot.
2. On the **Create Graph** tab, in the **2DGraphs** group, click **Ternary Plot**.

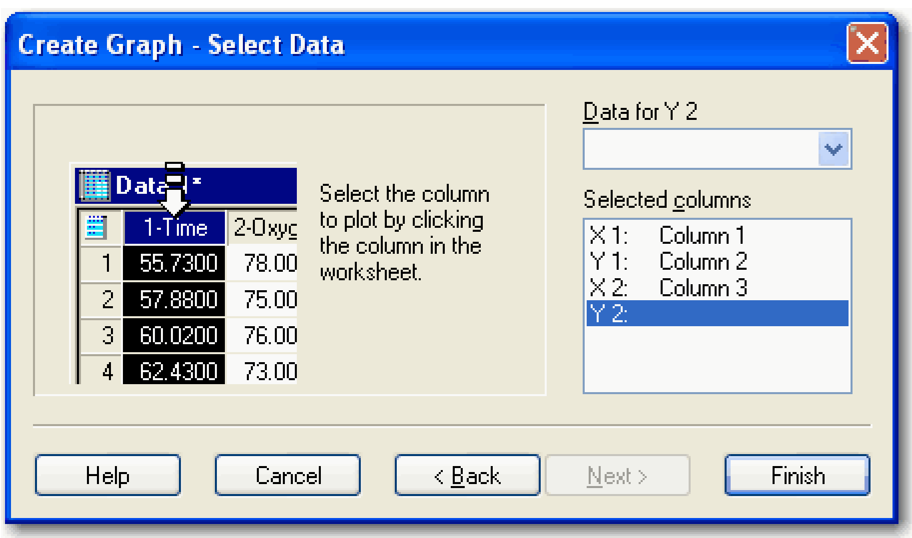


3. Click the style of ternary plot you want to create.
4. In the **Graph Wizard**, select the appropriate format.



5. Click **Next**. Since you selected columns prior to opening the Graph Wizard, your choices automatically appear in the dialog box.

Figure 89. Selecting Columns to Plot Using the Graph Wizard



Tip:

If you made a mistake picking columns, highlight the wrong entry in the Graph Wizard, then choose the correct column either in the worksheet or from the column list.

6. Click **Finish**.

   Use **Graph Properties** to modify the plot or to open the Graph Wizard to pick different data columns to plot or to add another plot to your graph. For more information, see Modifying Ternary Axes *(on page 353)*.

Modifying Ternary Graphs

Modifying ternary graphs involves:

- Changing axis properties.
- Picking new data for the plot.
- Changing line and symbol type, size, and color.
- Modifying backplane color and grid lines.

To modify a ternary graph, select the graph and modify it using **Graph Properties**. For more information, see Modifying Graphs Using Graph Properties *(on page 89)*.

Statistical Graphs

Statistical Graphs are exploratory graphs that allow you to make a visual assessment directly from your worksheet data without first having to run a statistical procedure. For more information, see Using SigmaPlot Statistics.

The graph styles currently supported are:

- Point and Column Means
- Scatter Plot Residuals
- Standardized Residuals
- Normal Probability Plot
- Quantile-Quantile Plot
- Confidence/Prediction Ellipses

Creating Statistical Graphs

To create a statistical graph:

1. Select the **Create Graph** tab.
2. In the **Statistics Graphs** group, click **Statistics**.

3. Select one of the seven available statistical graph styles and follow the Graph Wizard's instructions.

> **Tip:**
> What appears next in the Graph Wizard depends on which Graph Style you select. On any of the following Graph Wizard panels, click Help to learn about the available options for any specific Graph Style.

Related information

Point Plot and Column Means *(on page)*
Scatter Plot of the Residuals *(on page)*
Bar Chart of the Standardized Residuals *(on page)*
Normal Probability Plot *(on page)*
Quantile-Quantile Plot *(on page)*
Confidence/Prediction Ellipses *(on page)*

Chapter 7. Modifying Axes, Tick Marks, and Grids

Axes are the scales or rulers along which data is plotted.

2D Cartesian graphs have an X (horizontal) axis, and a Y (vertical) axis. For 3D graphs, the X and Y axes form the base of the graph, and the Z axis is the vertical axis. Polar plots use an angular axis to draw the circumference of the plot and the radial axes to draw the radius of the plot. An axis is always associated with at least one plot on a graph, and determines the scaling of the plot.

Each axis consists of pairs of lines that you can move and modify independently. *Tick marks* are short lines along the axis that represent scale intervals. You can display and modify tick marks for each axis. Grid lines are attached to the graph planes, and can be drawn at tick intervals for all axes. Make most axis modifications using Graph Properties.

Axis Scale Types

Scale types appear under **Axis** in the **Properties** list in **Graph Properties**.

1. Double-click an axis on a graph to open **Graph Properties**.
2. Select **Axis > Scaling** from the **Properties** list.
   The available scale types appear in the **Type** list. They include:
   - Linear
   - Common Log
   - Natural Log
   - Probability
   - Probit
   - Logit
   - Category
   - Date/time
   - Reciprocal
   - Weibull

Linear

A linear scale is a standard base 10 numeric scale. (This scale is recommended for a date axis when an exact representation of spacing depicted by dates is not required. Otherwise, use the date/time scale.)

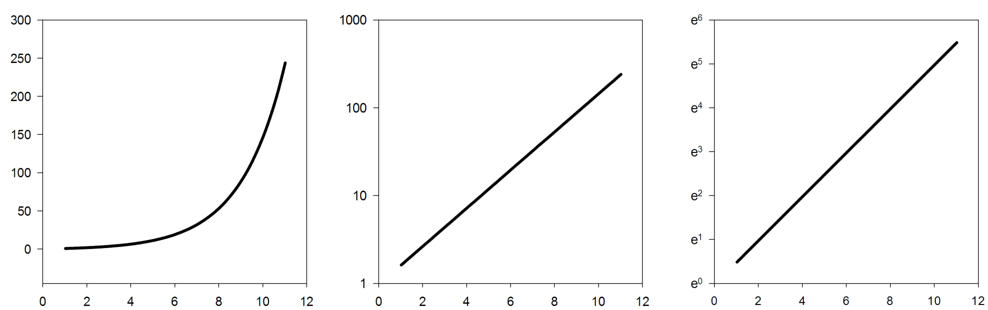
Common Log

A common log scale is a base 10 logarithmic scale.

Natural Log

A base *e* logarithmic scale.

Figure 90. Graphs of the Same Data Using Linear, Common Log, and Natural Log Scales



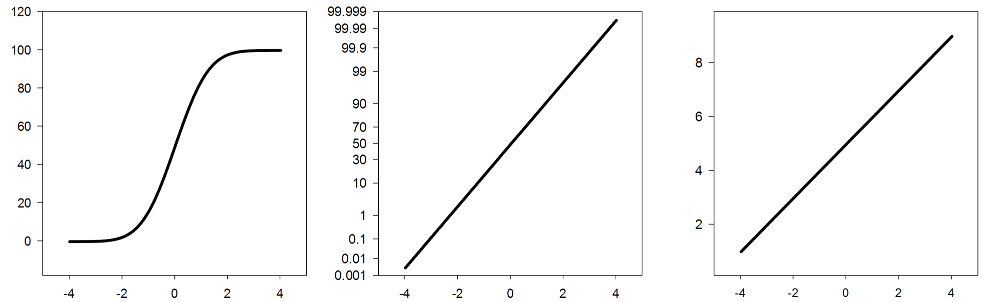
Probability

A probability scale is the inverse of the Gaussian cumulative distribution function. The graph of the sigmoidally shaped Gaussian cumulative distribution function on a probability scale is a straight line. Probabilities are expressed as percentages with the minimum range value set at 0.001 and the maximum range value set at 99.999. The default range depends on the range of the actual data.

Probit

A probit scale is similar to the probability scale; the Gaussian cumulative distribution function plots as a straight line on a probit scale. The scale is linear, however, with major tick marks at each Normal Equivalent Deviation (N.E.D. = X - μ)/σ) plus 5.0. At the mean (X = μ) the probit = 5.0; at the mean plus one standard deviation (X = μ + σ) the probit = 6.0, etc. The default range is from 3 to 7. The range limit for a probit axis scale is 1 to 9.

Figure 91. Graphs of the Same Data Using Linear, Probability, and Probit Scales



Logit

A *logit scale* uses the transformation

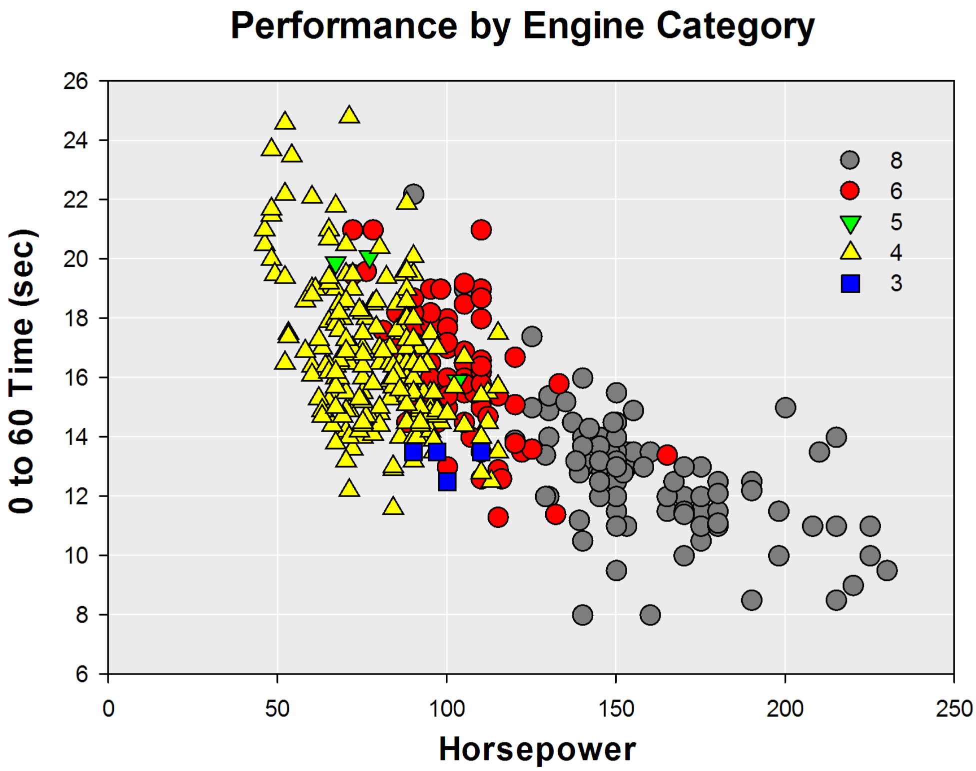
$$logit = \ln\left(\frac{y}{a-y}\right)$$

where *a* = 100 and 0 ≤ *y* ≤ 100.

Category

A category scale uses numerical values or text from a worksheet column used to generate a plot. Each distinct entry in the column is a separate category against which the corresponding data values are plotted. This scale is commonly used for bar charts or other plots used to graph different categories of data.

Figure 92. A Graph Showing the Category Scale



Any plot generated by plotting a column containing any text versus a column containing data will use a category axis automatically.

You can select a category scale for numeric data, and each unique value will be treated as its own category.

> **Note:**
> If a column contains more than one instance of the same category, the category appears only once, and all corresponding data is plotted within that category.

Date and Time

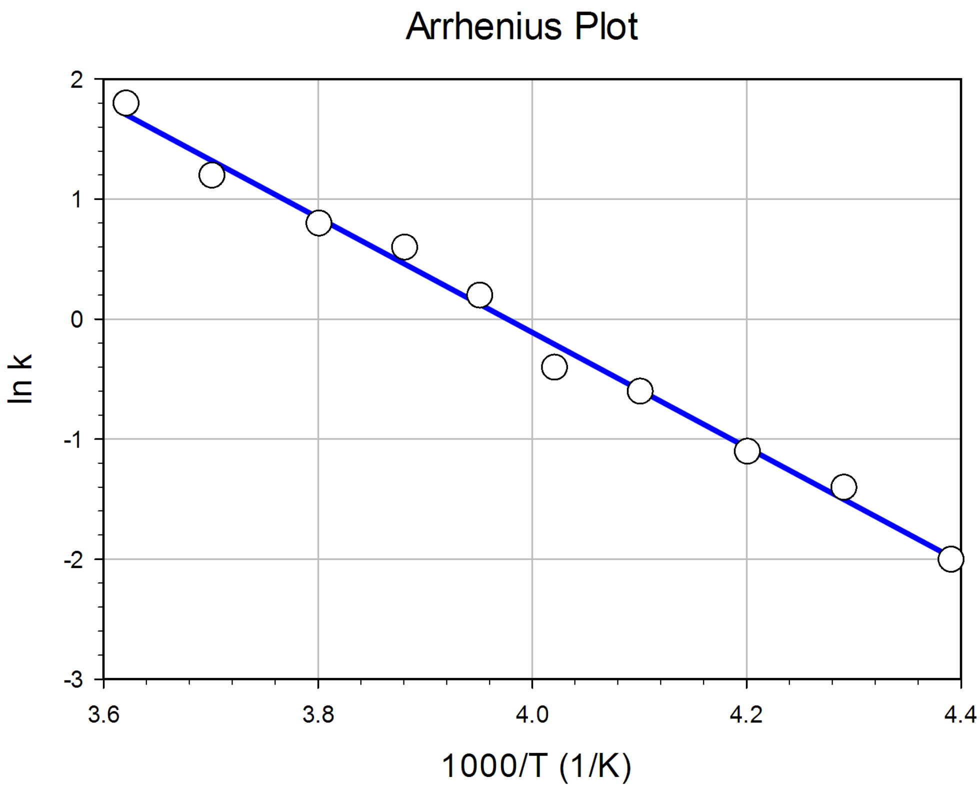
Date and time formatted data are automatically plotted using a Date/Time axis scale. This scale is specifically designed to handle true calendar date and time units, labeling and spacing. You can:

- Entering Dates and Times *(on page)*
- Change date and time labels. *(on page 328)*
- Change data and time intervals. *(on page 333)*

Reciprocal

A *reciprocal axis scale* uses the multiplicative inverse of a number, where *x* is the number which, when multiplied by *x*, yields 1. Its equation is 1/*x* or x^{-1}

Figure 93. An Arrhenius Plot with a Reciprocal Axis Scale



Researchers often use a reciprocal scale when creating graphs for reliability studies. For example, there is a theory that aging accelerates as temperature rises. The plot in this case would use a reciprocal temperature (1/T (1/mK)) x-axis and a log (ln k) y-axis. The slope of the line fitted through the plot is the activation rate of the studied chemical reaction, that is, the reaction causing the failure.

Weibull

The Weibull axis displays the Cumulative Percent Failure (CPF) using the Weibull distribution using the formula:

$$y = \ln\left(\ln\left(1/CPF/100\right)\right)$$

This scale is frequently used for life data analysis. The Failure Time, typically a log scale on the x-axis, is plotted against the Cumulative Percent Failure, typically on the y-axis.

Changing Axis Scales and Range

You can control the axis units and increments used in representing your data. Axis scale and range are modified within the Axis Scaling Properties found in **Graph Properties**.

You can also use transforms and tick labels and intervals from worksheet columns to create your own custom axis scales.

Changing Axis Range

Axis range includes the values of the starting and ending points of an axis. You can choose to set axis range automatically or manually.

To change the axis range:

1. Double-click the axis to modify to open **Graph Properties**.
2. Select **Axis > Scaling** from the **Properties** list.
3. **To automatically set the axis range,** select **Data Range** from the **Calculation** list. SigmaPlot automatically determines the axis range based on the data plotted.
   For log axes, or axes that forbid zero or negative numbers, the minimum is set to the nearest major tick mark beyond the smallest value.
4. **To manually set the axis range,** select **Constant** from the **Calculation** drop-down list, then type beginning and ending axis range values in the **Start** and **End** edit boxes.

   > **Note:**
   > Date/time axes display the ranges in date and time units.

5. Select **Pad 5%** to add padding to both ends of the axis.
6. Select **Nearest Tick** to extend the range to the nearest major tick mark.

Changing Scale Type

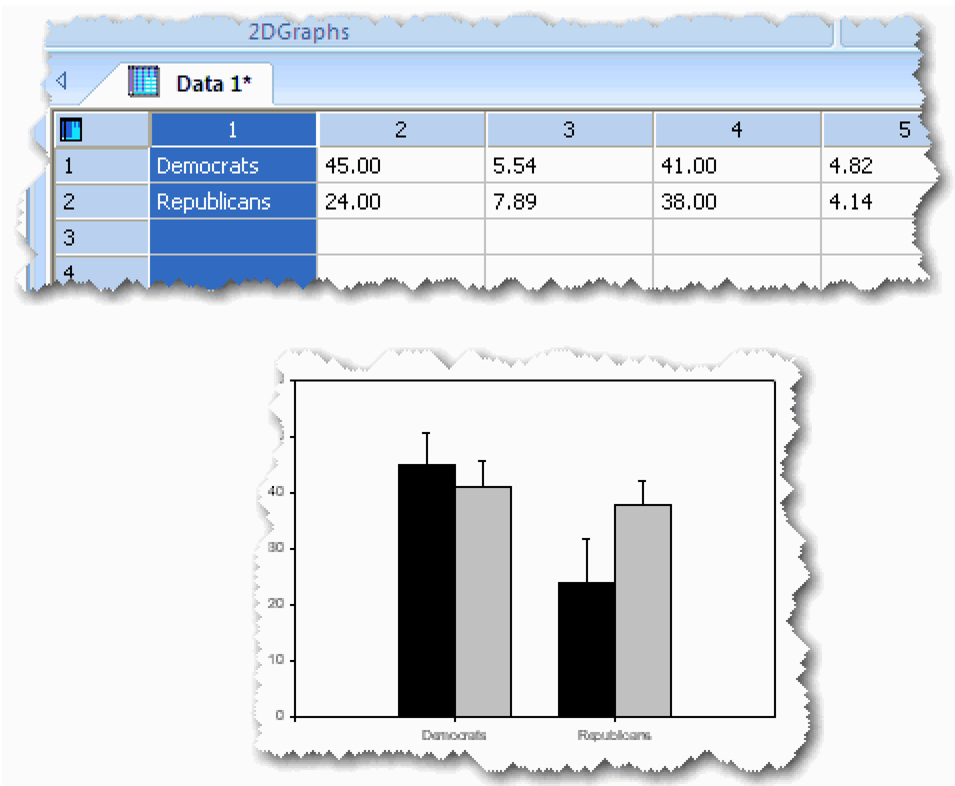
To change an axis scale type:

1. Double-click the axis to modify to open **Graph Properties**.
2. Select **Plot > Scaling** from the **Properties** list.
3. Select the desired axis scale type from the **Scale type** drop-down list.

The default axis scales are **Linear** for all numeric data, **Category** for text data, and **Date/Time** for date and time data.

Using a Category Scale

Use the category scale type by plotting a column containing categories against other columns of data values, or modify an already existing plot to use a category scale by changing the axis scale type to **Category**, then using the Graph Wizard to re-pick the data and assign your category column as the X or Y coordinate values.



1. To plot a column of text as a category scale:
    a. Enter your category data (text) into a worksheet column, and corresponding data into adjacent worksheet columns.
    b. On the **Create Graph** tab, click the graph type and style you want to create.
    c. In the **Graph Wizard** , select the data format, and click **Next**.
    d. Since you have not already selected your data from the worksheet, click the worksheet columns to assign them under **Selected Columns**. Plot your category column as the category axis data type, and pick your other column(s) as the corresponding data type.
    e. Click **Finish** to create the graph.
2. To modify a plot to use a category scale:

a. Double-click the axis you want to modify to open **Graph Properties**.

b. Select **Axis > Scaling** from the **Properties** list.

c. Select **Category** from the **Scale type** drop-down list.

d. Click the **Create Graph** tab, and then in the **Wizard** group, click **Graph Wizard**.
The **Graph Wizard - Modify Plot** dialog box appears.

e. Under **Data Format**, select the data format you want to use, and click **Next**.

f. Click the columns in the worksheet to choose the worksheet columns to assign to plotted data under **Selected Columns**. Plot your category column as the data type you want to use as the category axis, and pick you other columns(s) as the corresponding data type.

g. Click **Finish** to create the graph with the newly assigned worksheet data and modified data.

Using a Date and Time Scale

SigmaPlot graphs date and time data from worksheet columns as specific calendar dates and times against which corresponding data values in other columns are plotted.

To create a plot using a date/time scale:

1. Enter dates or times into a column of a worksheet. For example, enter 1/1, 2/1, 3/1, etc., indicating months and days.
2. Enter corresponding data into a separate worksheet column or columns.
3. Drag the pointer over both the date and data columns.
4. Create the graph using the **Graph** toolbar or the Graph Wizard.
5. Plot your date and time column as the date/time axis.
6. Pick your other column(s) as the corresponding axis.
7. Click **Finish** in the Graph Wizard to create the graph.

Using a Custom Axis Scale

Use the transform language to transform your data for a new axis scale, then use tick intervals from a column to the place correct ticks marks and labels.

For example, to use an Extreme Value Distribution scale, apply the transform:

```
f(y)=ln(ln(100/(100-y)))
```

and for the Arrhenius scale, use the transform:

```
f(y)=1-273/(T+273)
```

Apply the transform to both your original interval values and data, then plot the transformed data using the transformed intervals as the tick mark values, and the original interval data as tick labels.

Hiding, Displaying, and Deleting Axes

The easiest way to hide an axis is to select it, then press Delete. The axis is hidden rather than deleted. You can also hide an axis by right-clicking the axis, then choosing Hide.

Control the display of axes using the Axis Lines settings in Graph Propertiesr.

To view, hide or modify the display of an axis:

1. Double-click the axis to open **Graph Properties**.

> **Tip:**
> You can also double-click hidden axes.

2. Select **Axis > Lines** from the **Properties** list.
3. Under **Show/place axes**, select an axis to display that axis, or clear an axis to hide it. Hidden axes hide all ticks and labels associated with that axis.

> **Note:**
> You can hide 3D axes, but if frame lines are active, a line will remain present. Also, if the graph has grid lines, a line will remain present. For more information, see Displaying Grid Lines and Backplanes *(on page 344)*.

Changing Axis Line, Color, and Thickness

Use Graph Properties to change axis color and thickness.

To change the color and thickness of an axis:

1. Double-click the axis to open **Graph Properties**.
2. Select **Axis > Lines** from the **Properties** list.
3. **To change the color of the axis,** under **Line properties**, select a color from the **Color** drop-down list. Choose **(None)** to make the axis transparent, and choose **(Custom)** to open the **Custom Color** dialog box.
4. **To change the thickness of the axis,** move the **Thickness** slider or type a thickness in the **Thickness** box.

> **Note:**
> 3D graph frame lines are drawn over axes lines and may obscure 3D axes modifications.

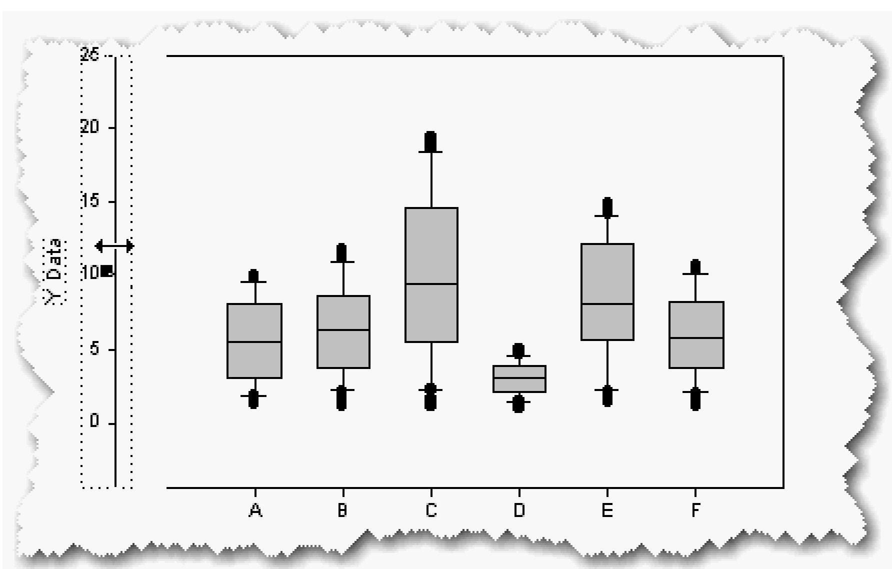
Moving Axes

To move a 2D axes, select it and then move it with your mouse. You cannot move 3D axes, but you can hide them from view.

Moving 2D Axes Manually

To move a 2D axis with the mouse, select the axis and drag it to a new position. Y axes move only horizontally and X axes only vertically. Moving ternary graph axes changes the axis range and scale, along with the size and shape of the graph. Axis titles move with the axis.

Figure 94. Moving an Axis by Dragging



Moving Axes to a Precise Location

Use the Axis Lines settings in Graph Properties to position axes a precise distance from the graph origin. For more information, see Modifying Ternary Axes *(on page 353)*.

To move an axis:

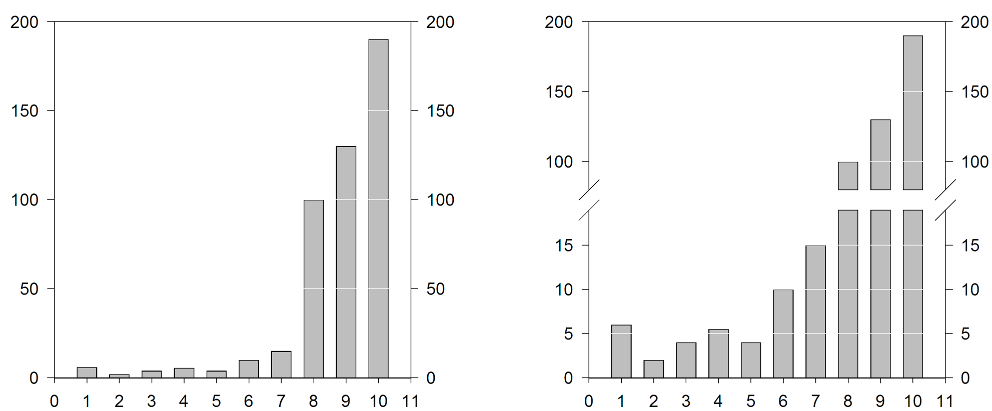
1. Double-click the axis you want to move to open **Graph Properties**.
2. Select **Axis > Lines** from the **Properties** list.
3. Under **Show/place axes**, move the sliders to change the percentage in the **Top** and **Bottom** boxes for X axes or Y axes, or type the value in the fields. .
   Locations are described as the percentage of the graph dimension the axes lie from the original position. To move an axis up or right, enter a percent greater than 0% (positive). To move an axis down or left, enter a percent less than 0% (negative). The defaults are 0.0%, and Normal.

Setting Axis Breaks

You can set axis breaks for 2D Cartesian graphs over specific ranges, at a specific location along the axis and you can change the major tick intervals that occur after the break. You can also use several different break symbols.

Restriction:
You can't create axis breaks on a graph that uses a date and time axis scale.

Figure 95. A Graph Before and After the Addition of a Y Axis Break



Creating an Axis Break

To create an axis break:

1. Double-click the axis where you want to add the break to open **Graph Properties**.
2. Select **Axis > Breaks** from the **Properties** list.
3. Under **Break range**, select **Show break**.
4. In the **Omit** boxes, enter the **Break** to omit.
5. **To specify the break position,** move the **Position** slider or enter a specific value.
   The location of the break is determined as a percent of the total axis length, from the origin.
6. **To set the width of the space between break lines**, move the **Gap Width** slider or enter a specific value.
7. **To set a post break interval,** type a value in the **Post Break Interval** box.
   The default value is the interval specified for the axis range.

   > **Note:**
   > Tick values from a column are not applied to the post break interval.

8. **To set axis break properties,** under **Break properties** from the **Symbol** drop-down list, select a break symbol type then use the **Length**, **Color**, and **Thickness** options.

Working with Axis Titles and Tick Labels

SigmaPlot automatically labels graph axes with titles and tick labels. Axis titles can be modified like any other text label.

Editing an Axis Title

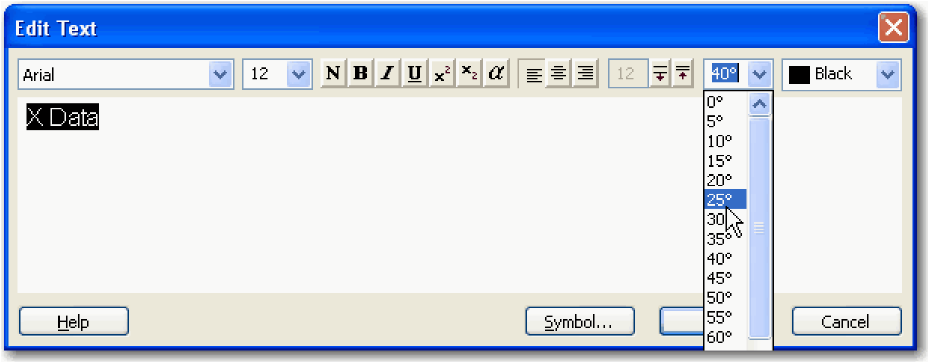
To edit an axis title:

1. On the graph page, select axis title. The title appears highlighted.
2. Make your changes to the title.

Rotating Axis Titles

To rotate an axis title:

1. Right-click the axis title, and then click **Edit**. **Edit Text** dialog box appears.



2. Select a degree of rotation for the selected label from the **Rotation** drop-down list.

Viewing and Hiding Axis Titles and Tick Labels

The easiest way to hide a graph axis title or tick label is to click it and press delete. You can also right-click, and select **Delete**.

Moving an Axis Title

To move an axis title, drag it with the mouse, just like any other text label.

Note:
Axis title position, relative to the axis, remains constant when the axis or graph is moved.

Changing Tick Mark Intervals

Use Graph Properties to modify tick intervals *(on page 333)*. You can also change tick marks for ternary graphs. For more information, see Changing Tick Labels *(on page 339)*.

Important:
Tick Intervals options vary depending upon the axis scale used. For example, there are no tick interval options for category axes.

Changing Probit Scale Tick Mark Intervals

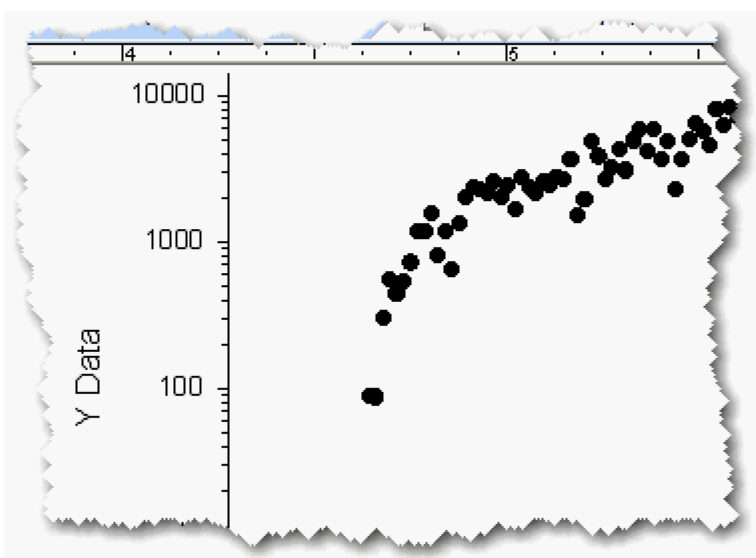
To change the tick intervals for linear and probit axis scales:

1. Double-click the tick marks you want to change to open **Graph Properties**.
2. Select **Axis > Scaling** from the **Properties** list.
3. **To change major tick intervals:**
    a. Select **Axis > Major Ticks** from the **Properties** list.
    b. Under **Tick intervals**, select either **Manual**, **Automatic**, or a column that contains the tick intervals.
    c. If you select **Manual**, enter interval values by typing into the **Every** and **From** boxes. The value in the **Every** field specifies how often major tick marks appear, and the **From** value specifies and origin point on the axes from which major tick marks start appearing. For example, if you type 0 into the **From** field and the 2 into the **Every** field, the major tick marks appear at even numbers on the axis. If you type 1 into the **From** field , the major tick marks appear at odd numbers on the axis.
4. **To set custom tick intervals,** choose the major tick interval values from the worksheet column available in the **Major ticks** drop-down list. Custom tick intervals are not available for minor ticks.

Tick Intervals for Log Axes

You can only specify log axis major tick marks automatically or from a column. However, you can select specific intervals for log scale minor ticks.

Figure 96. A View of a Graph with Log Y Axis Minor Ticks



To change log scale minor tick intervals:

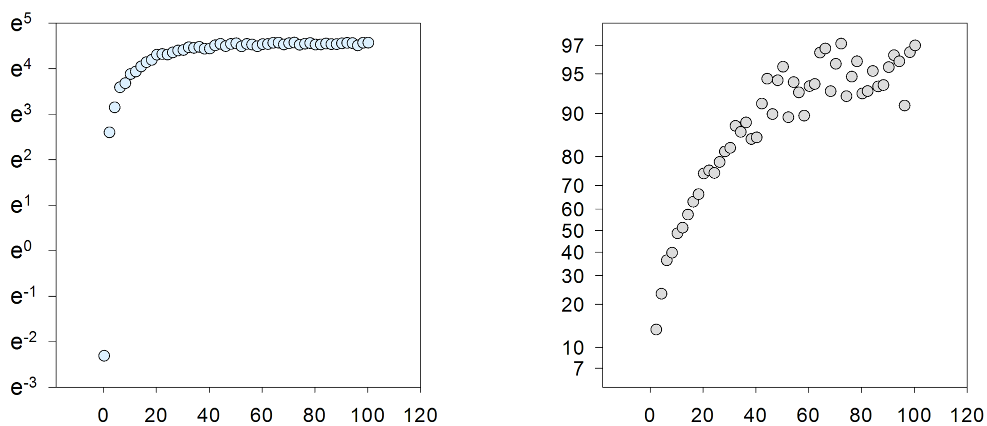
1. Change the axis scale to a log axis. For more information, see Changing Axis Scales and Range *(on page 326)*.
2. Double-click the tick marks to open **Graph Properties**.
3. Select **Axis > Minor Ticks** from the **Properties** list.
4. Under **Tick intervals**, select an interval from the **Minor tick intervals** drop-down list.

Natural Log and Logit Scales

Natural log and logit scales have only Automatic and from column Tick Intervals.

Natural log intervals occur at every factor of e. Logit ticks occur at 7, 10, then every ten until 90, then 95 and 97.

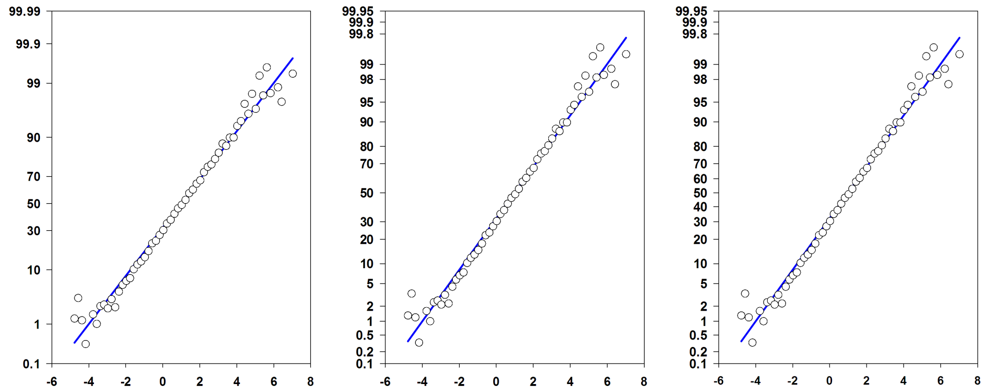
Figure 97. Tick Intervals for Natural Log and Logit Scales



Tick Intervals for Probability Scales

Probability scale axes have no minor ticks, but have three different settings for major tick intervals, coarse, medium, and fine, as well as the option to set tick intervals from a worksheet column.

Figure 98. Coarse, Medium and Fine Tick Intervals for Probability Scales



To specify the tick mark density for probability scales:

1. Double-click the tick marks to open **Graph Properties**.
2. Select **Axis > Major Ticks** from the **Properties** list.
3. Under **Tick intervals**, select a density from the **Major ticks** drop-down list.

Tick Intervals for Date and Time Axes

SigmaPlot automatically sets both major and minor tick intervals that are computed from the data range. You can also manually set Major Ticks and Minor Ticks.

To set tick intervals for a date/time axis:

1. Double-click the tick marks to open **Graph Properties**.
2. Select **Axis > Major Ticks** or **Axis > Minor Ticks** from the **Properties** list.
3. Under **Tick intervals**, from the **Major ticks** or **Minor ticks** drop-down list, select a tick interval type, Tick intervals are defined by the unit Type used and the selected Count. Dates fall at 12:00 AM of the first day for that period. The major tick interval options available are limited by the data range. You are prevented from selecting time units that would create too many tick marks.

CAUTION:
Do not select a minor interval that creates hundreds or even many thousands of minor tick marks.

4. **To increase the period between tick occurrences,** change the **Count**. For example, set ticks to occur every other Type date by changing the Count to 2, or every fifth by changing the count to 5. Counts must be positive integers.

Customizing Tick Intervals

You can specify major tick locations by entering major tick values into a worksheet column, then selecting that column in Graph Properties.

Restriction:
Custom tick intervals are not available for minor ticks.

To use worksheet columns to customize tick intervals:

1. Enter the desired tick marks into an empty worksheet column.
2. Double-click the tick marks to open **Graph Properties**.
3. Select **Axis > Major Ticks** from the **Properties** list.
4. Under **Tick intervals**, from the **Major ticks** drop-down list, select the column number or title of the column you want to use for major tick marks. The numeric values of the intervals are automatically used for tick labels, that you can modify them like any other tick labels.

Changing Tick Mark Appearance

Use Graph Properties to modify tick appearance including tick length and color. You can also specify tick mark direction, or hide tick marks altogether.

You can change:

- Tick marks for polar plots.
- Tick marks for ternary graphs.

Tick Mark Direction

To turn tick drawing on and off and to select tick directions for both sides of an axis:

1. Double-click tick mark to open **Graph Properties**.
2. Select **Axis > Major Ticks** or **Axis > Minor Ticks** from the **Properties** list.
3. From the **Direction** drop-down list for either axis:
   - Select **Outward**, to point tick marks away from the graph.
   - Select **Inward** to point tick marks toward the inside of the graph.
   - Select **Both** to point tick marks in both directions.
   - Select **(none)** to hide tick marks.

> **Note:**
> The options that appear under **Direction** are dependent upon what type of graph you are modifying. If you are modifying a 3D plot, then the options are **Front** and **Rear**. If you are modifying a polar plot with a radial axis, then the options are **Outer** and **Inner**. In a polar plot with a radial axis, you change the direction of the spokes.

Directions for tick marks are independent for either side of the axis.

Hiding Tick Marks

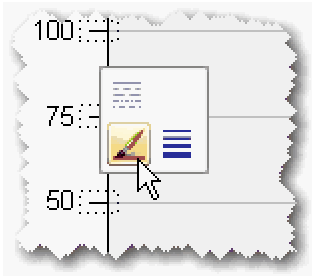
To hide tick marks:

1. Click the tick marks on the page.
2. Press Delete, or right-click and from the shortcut menu, click **Hide**.

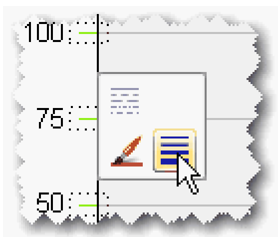
Changing Tick Mark Line Attributes

To change tick mark length, color, and thickness:

1. Double-click the tick mark to open **Graph Properties**.
2. Select **Axis > Major Ticks** or **Axis > Minor Ticks** from the **Properties** list.
3. **To change tick length,** under **Tick lines**, select a length from the **Tick length** drop-down list. You can either manually type in a value or move the slider.
4. **To change tick color,** select a tick on the graph.



5. In the pop up menu that appears, click the **Color** button, and then select a color from the palette that appears. Select **(none)** to create transparent tick marks. For more information, see Using Custom Colors and Incrementing Schemes *(on page 199)* .
6. **To change tick thickness,** select a tick on the graph.



7. In the pop up menu that appears, click the **Thickness** button, and then select a thickness from the palette that appears.

Changing Tick Labels

SigmaPlot can display tick labels for:

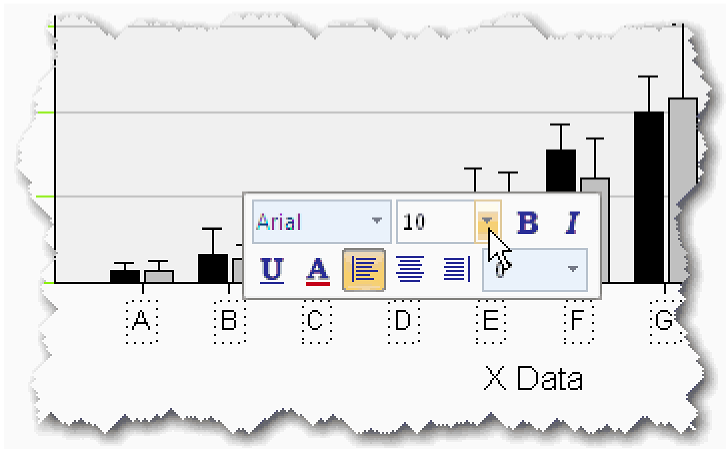
- Both major and minor tick marks.
- Tick marks.
- Standard numeric labels.
- Time and series labels.

You can also add a suffix or prefix to all major or minor tick labels on a selected axis, and modify the calculation and precision of numeric labels, view different dates and times, select among many different series labels, and change the font and other text attributes.

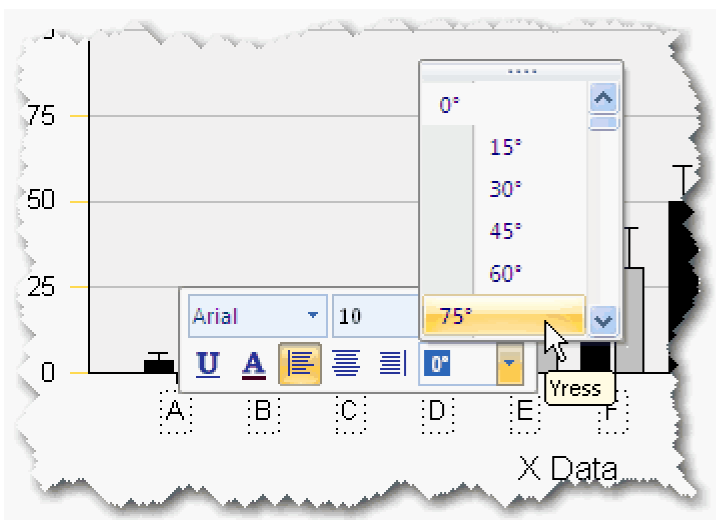
Changing Tick Label Font and Other Text Attributes

To change the font size, style, or color of tick labels:

1. Select a tick label.
2. Edit the font size, style, and color properties from the pop up menu which appears.



3. **To rotate tick labels,** select a tick label, and on the pop up menu that appears, select form the **Rotation** drop-down list. For more information, see Editing Text *(on page 183)*.



Changing Tick Label Type

You can change the type of tick label used for all axis types except for category axes.

1. Double-click a tick label to open **Graph Properties**.
2. Select **Axis > Tick Labels** or from the **Properties** list.
3. **To use a numeric type of tick label,** from the **Type** drop-down list, select **Numeric**, then use the **Label appearance** options.

4. **To use a series type of tick label,** from the **Type** drop-down list, select **Series**.

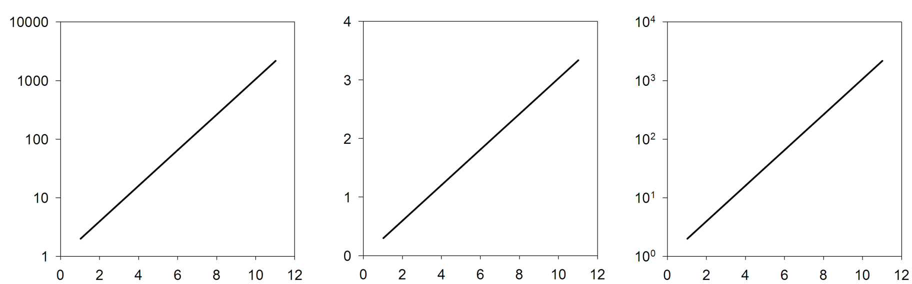
> **Important:**
> If you want to plot data versus true calendar dates, you should have entered date and time data in the worksheet, and use a date/time axis scale.

Formatting Numeric Tick Labels

To format numeric tick labels:

1. Double-click the tick labels of the axis you want to change to open **Graph Properties**.
2. Select **Axis > Major Ticks** or **Axis > Minor ticks** from the **Properties** list.
3. Under **Label appearance**, from the **use** drop-down list, select the type of label notation to use.
    - Select **Scientific Notation** or **Engineering Notation** for large numbers only when numbers exceed a specified range. Use the **When below** and **or above** drop-down lists to specify the range beyond which scientific notation or engineering notation is used. Once a label exceeds the range, then all the labels will use the specified notation.
    - For log axes, you can select to display the number, only the **Exponent**, or both the **Base and exponent**.
    - For linear axes, you can select **Scientific notation** or **Engineering notation** to use always, or you can select **Scientific notation, for large numbers** or **Engineering notation, for large numbers** to use only when needed for large numbers. To specify when scientific notation is needed, enter the lower and upper ranges in the **When below** and **or above**.

Figure 99. Log Scale Y Axes Using Numbers, Exponent Only, and Base and Exponent



4. **To specify the number of places used to display numeric tick labels,** under **Precision**, select **Automatic** to let SigmaPlot automatically determine precision, or select **Manual**, then select the number of decimal places to use from the **Number of places** drop-down list.
5. **To divide numeric tick label values by a specific number,** enter a divisor in the **Factor Out** drop-down list. A value of 2 divides label values in half, a factor of 0.5 doubles the tick label values, etcetera.

Formatting Series Tick Labels

To format series tick labels:

1. Double-click the tick labels of the axis you want to change to open **Graph Properties**.
2. Select **Axis > Major Ticks** or **Axis > Minor Ticks** from the **Properties** list.
3. Select **Series** from the **Type** drop-down list.
4. From the **Series** drop-down list, select a series.
5. From the **Length** drop-down list, set the number of characters to use for the tick label.
6. From the **Start at** drop-down list, specify which series item to begin labeling tick marks with.
7. From the **Step by** list, set the frequency, or increment, of series items to use.
   For example, if you are using a **Days of the Week** series, you might choose to start with Monday, and to step labeling by 2 days at a time. Tick labels appear as Monday, Wednesday, Friday, Sunday, Tuesday, etc.
8. **To re-start tick labeling from a specified point,** use the **After** and **Repeat From** drop-down lists.
   For example, if you were using a **Days of the Week** series, and were stepping by 2 days at a time, you might use the **After** and **Repeat From** lists to specify that after Friday, repeat the series from Monday. Tick labels appear as Monday, Wednesday, Friday, Monday, Wednesday, Friday, etc.

Adding a Prefix or Suffix to Tick Labels

To add a suffix or prefix to the major or minor tick labels on a selected axis:

1. Double-click the axis you want to change to open **Graph Properties**.
2. Select **Axis > Major Labels** or **Axis > Minor Labels** from the **Properties** list.

3. **To add a prefix or suffix to the major or minor tick labels,** under **Add to major tick labels**, type the prefix or suffix into the appropriate **Prefix** or **Suffix** boxes. All labels on the selected axis appear with the specified suffix or prefix.

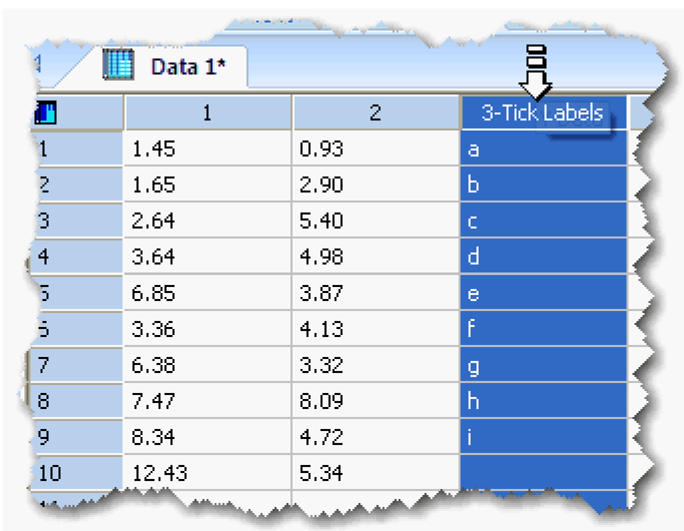
> **Tip:**
> You can use any keyboard or extended characters. Use the **Windows Character** map accessory program, or Alt+Numeric keypad combinations to enter extended characters like degrees symbols (Alt+0176).

Using Custom Tick Labels

You can enter text and numbers into worksheet columns and use them as major tick labels.

To customize tick labels using worksheet columns:

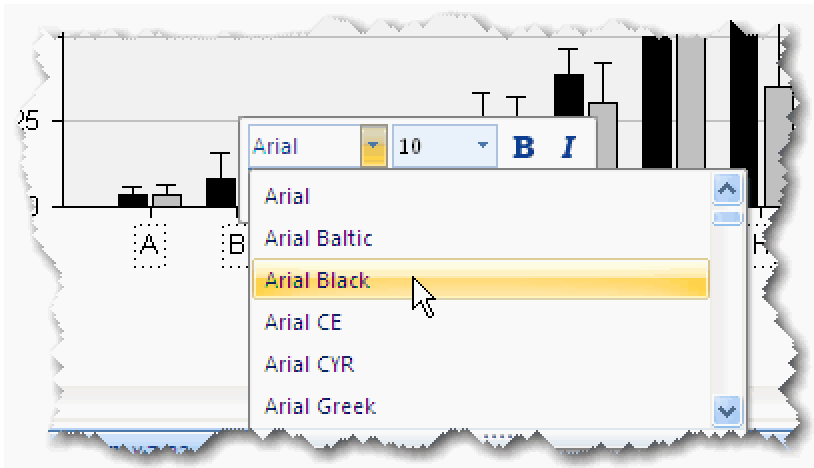
1. Enter the labels you want to use in a worksheet column in the order you want them to appear. Enter minor labels in the right adjacent column.



> **Tip:**
> To skip specific labels, leave an empty cell for that tick mark when entering the labels into the worksheet column.

2. Double-click the axis tick labels you want to modify to open **Graph Properties**.
3. Select **Axis > Tick Labels** from the **Properties** list.

4. Select the column in which you entered the tick labels from the **Type** drop-down list. Labels for minor ticks are automatically taken from the column to the right of the major tick labels.
5. **To change the font used for the tick labels,** select the tick label to view the shortcut menu, and then select a font from the **Font** drop-down list.



Displaying Grid Lines and Backplanes

Display and modify grids for each graph plane using Graph Properties. Grid lines are associated with both a backplane and one of the two axes which form the plane. If a graph has multiple axes, the axes used are the original pair.

You can choose to turn on and modify grid lines for both major and minor tick intervals.

Modifying Graph Planes

To change graph planes:

1. Double-click the graph to open **Graph Properties**.
2. Select **Graph > Graph Planes** from the **Properties** list.
3. If your graph is a 3D graph, select the plane to modify from the **Plane** list.

> **Note:**
> When modifying a 2D graph, only one plane is available.

4. **To select a background color for the selected plane,** under **Background**, select a color from the **Color** drop-down list.

Select any of the listed colors, or select **(Custom)** to use or create a custom color.

5. **To create a transparent plane,** select (none) . Transparent planes are especially useful when superimposing graphs over one another. The grid lines available for Cartesian plots are X, Y, and Z for 3D plots. The grid lines for polar plots are for the Angular and Radial axes. Ternary plots have X, Y and Z direction grid lines.

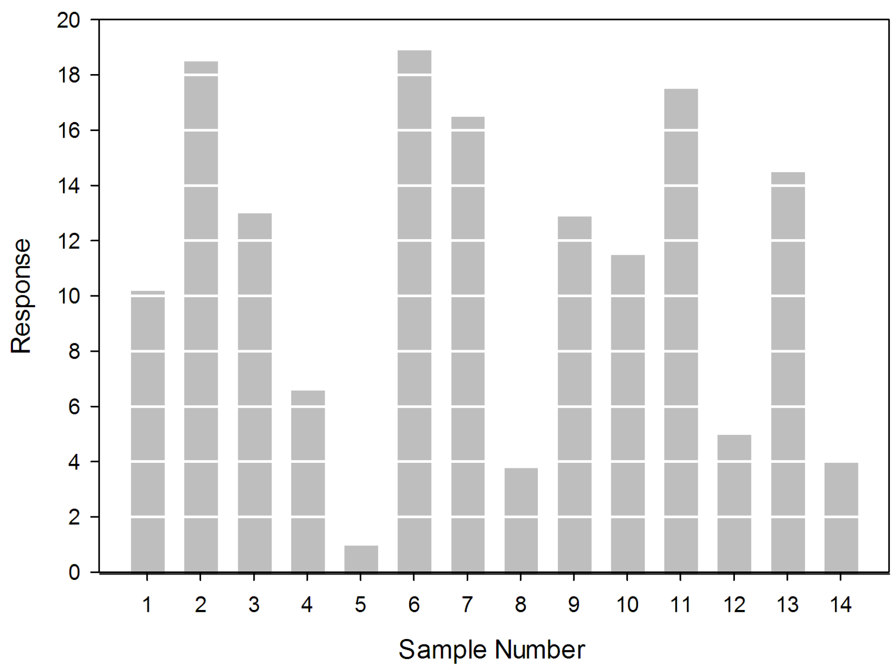
Modifying Grid Lines

To change major or minor grid lines:

1. Double-click the graph to open **Graph Properties**.
2. Select **Graph > Grids** from the **Properties** list.
3. **To change grid line thickness,** under **Grid lines**, move the **Thickness** slider or type a thickness value in the **Thickness** box.
4. **To change grid line style,** under **Line properties**, select a type from the **Line Type** drop-down list.
5. **To change grid line color**, under **Line properties**, select a color from the **Color** drop-down list. Choose any of the listed colors, or choose **(Custom)** to use or create a custom color. Choose **(none)** to turn off grid lines.
6. **To change or add a gap color**, select a color from the **Gap Color** drop-down list. This option is only available if you select a line type with actual "gaps" in it, like dotted or dashed, for example.

7. **To move the grid behind or in front of the plot**, from the **Layering** drop-down list, select to move either the plot or grid to the front. This feature is especially useful for bar charts, and is not available for 3D plots.

Figure 100. A Bar Chart with a White Backplane and White Grid Lines Placed in Front of the Plot



Hiding and Viewing Grid Lines

To view hidden grid lines, or hide visible grid lines:

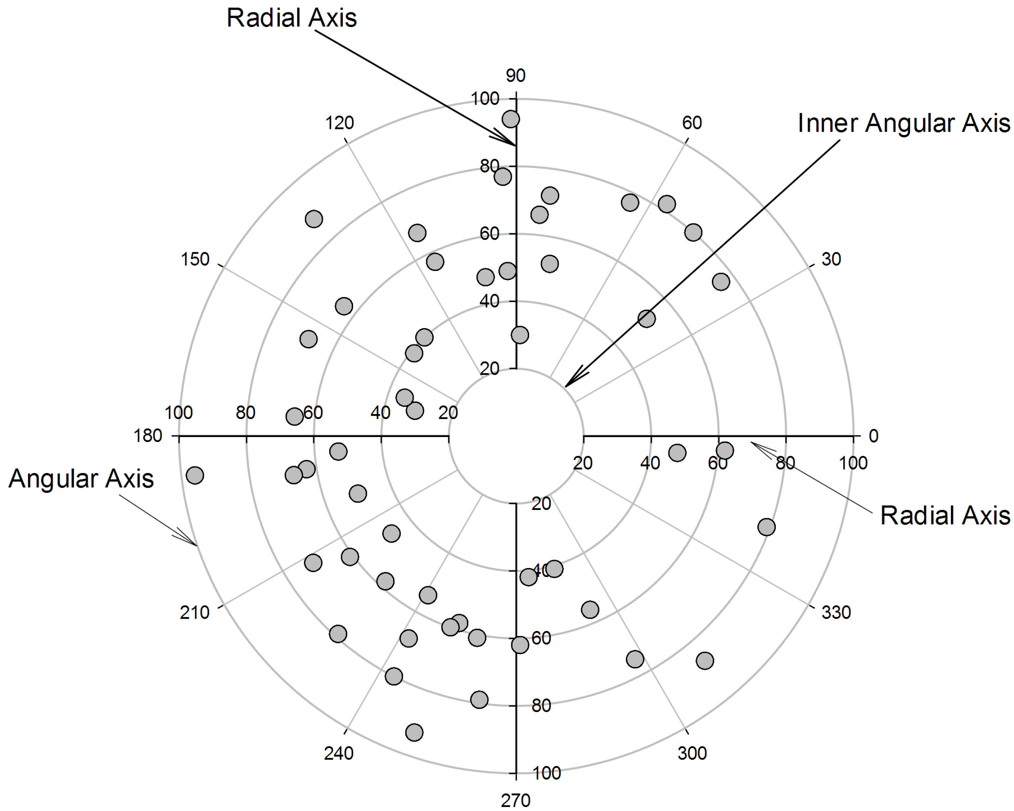
1. Double-click the graph to open **Graph Properties**.
2. Select **Graph > Grids** from the **Properties** list.
3. **To hide grid lines,** under **Style**, select **(none)** from the **Line Type** drop-down list.
4. **To display grid lines,** select any style other than **(none)** from the **Line Type** drop-down list.

Modifying Polar Axes

Polar plots have a radial axis and an angular axis. The angular axis describes a circle and can use radians, degrees, or other units as the scale. There are both outer and inner angular axes.

The radial axes are spokes of the circle and scale the distance from the center of the circle (the radius, or R). There are four radial axes, referred to as spokes 1-4.

Figure 101. A Diagram of the Axes of a Polar Plot



Restriction:

Axis breaks cannot be created for either radial or angular axes.

Angular Axes

You can draw angular axes along the inner and outer circumferences of the graph. By default, the inner axis is not displayed. You can modify angular axes by:

- Changing axis titles.
- Displaying or hiding either axis.
- Changing axis lines.
- Changing axis scaling, range, and rotation.
- Changing tick marks.
- Changing axis tick labels.

Changing Angular Axis Scaling and Position

Polar plot angular axis scale and range settings control the axis units and increments used to plot data. You can modify axis scale, range, units, and rotation using the Scale settings on in Graph Properties.

To change an axis scale, range, units, and rotation:

1. Double-click the plot to open **Graph Properties**.
2. Under **Current**, select **Angular Data** from the **Axis** drop-down list.
3. Select **Axis > Theta Scaling** from the **Properties** list.
4. **To change the axis scale used,** select the desired axis scale type from the **Type** drop-down list.
5. **To change the measurement units of the angular axis,** select measurement units from the **Axis Units** drop-down list. If you don't see the axis units you want to use for your polar plot listed in the list, select **Other**, then type new axis range values in the **From** and **To** boxes under **Range**. If using a predefined measurement unit, the **From** and **To** box values are entered automatically. For more information, see Using a Custom Axis Scale *(on page 328)*.

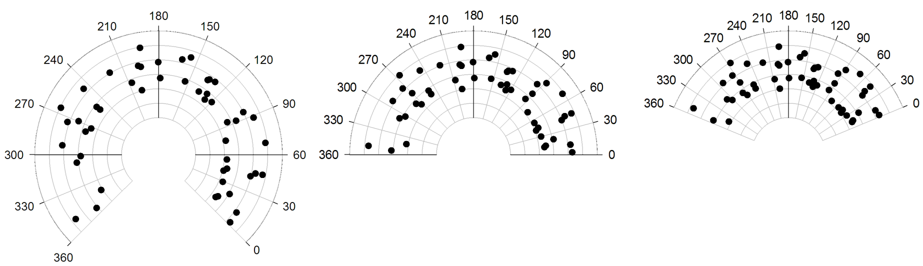
   > **Note:**
   > The only effect of changing units is to change the predefined axis range. This range can be manually changed regardless of the current units.

6. **To change the size of the displayed arc of the polar plot,** move the **Arc** slider. A setting of 360 degrees displays the entire circle, 270 degrees displays three-quarters of the circle, and 90 degrees displays half of the circle.

   > **Tip:**
   > If you change the arc of the angular axis, the axis range remains the same. The current axis range appears along the new distance of the arc.

7. **To change the start angle for the displayed arc,** move the **Start angle** slider. The default is 0 degrees (3 o'clock). Rotation is counterclockwise.

Figure 102. Polar plots with: Starting angle of 315° and arc of 270°; start angle of 0° and arc of 180°; and start angle of 135° and arc of 22.5°



Moving Angular Axis Positions

You can drag both inner and outer angular axes closer or further from the center of the graph. Select the axis, and move it using the mouse.

To set exact locations for angular axes:

1. Double-click an angular axis to open **Graph Properties**.
2. Under **Current**, select **Angular Data** from the **Axis** drop-down list.
3. Select **Axis > Lines** from the **Properties** list.
4. **To change the percentage in the Outer and Inner axes,** under **Show/place axes**, move the **Outer** and **Inner** sliders or enter values.
   Locations are described as the percentage of the distance the axes lie from the center of the graph. To move an axis out, increase the percent. To move an axis in, decrease the percent.

Radial Axes

The radial axes are drawn along the radius of the graph, and by default are displayed as four axes extending from the center of the graph to the outer of edge the graph. Each of the radial axes is a representation of the same data, so the range and scale must be the same for each radial axis; however, you can modify the color, tick marks, labels, location, and display of each radial axis independently.

Modify radial axes by:

- Displaying or hiding any axis.
- Changing display of axis and tick label titles.
- Changing axis lines.
- Changing axis scaling.
- Changing tick marks.
- Changing axis tick label type.

Modifying Radial Axes Lines and Position

To control polar plot radial axes line settings:

1. Double-click the graph to open Graph Properties.
2. Under **Current**, select **Radial Data** from the **Axis** drop-down list.
3. Select **Axis > Radius Lines** from the **Properties** list.

Moving a Radial Axis

To move a radial axis:

1. Select the axis on the page.
2. Use the mouse to drag it to a new location. Radial axes rotate about the center of the graph like the spokes of a wheel.

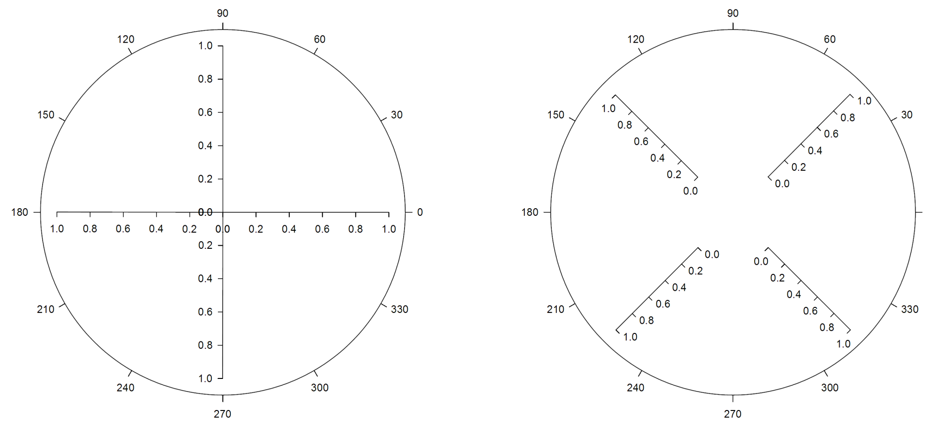
Setting Radial Axis Positions to Exact Degree Positions

To set radial axis positions to exact degree positions

1. Double-click a radial axis to open Graph Properties.
2. Under **Current**, select **Radial Data** from the **Axis** drop-down list.
3. Select **Axis > Radial Lines** from the **Properties** list.
4. **To move a radial axis,** under **Show/Place Axes**, move the sliders to set a new location. The axis location is in degrees from 0 degrees (3 o'clock). The defaults are 0 degrees, 90 degrees, 180 degrees, and 270 degrees.
5. **To offset an axis from the center of the graph,** move the **Axes start** slider to change the length of the radial axes.

Setting the slider to 0% draws the axis from the center of the graph outward, 25% draws the axis beginning a quarter of the distance from the center, 50% draws it half the distance from the center, and so on.

Figure 103. Radial Axes in the Default Positions, and Offset by 45 degrees with an Axes Start of 30%



Displaying and Modifying Radial Axes Lines

To display and modify radial axes lines:

1. Double-click a radial axis to open **Graph Properties**.
2. Under **Current**, select **Radial Data** from the **Axis** drop-down list.
3. Select **Axis > Radial Lines** from the **Properties** list.
4. **To view or hide a radial axis,** select **Spoke 1**, **2**, **3**, or **4**.
5. **To change line color and thickness,** under **Line Properties**, select a color and thickness from the **Color** and **Thickness** drop-down lists.

Displaying and Changing Radial Axis Ticks and Labels

Use Graph Properties Tick Label settings to display polar radial axis labels, and modify tick labels. Angular axes labels are analogous to standard Cartesian graph titles and labels; however, radial tick marks and labels have additional positioning options.

Other than display and position, polar plot tick marks and labels have the same options as Cartesian graph tick marks and labels.

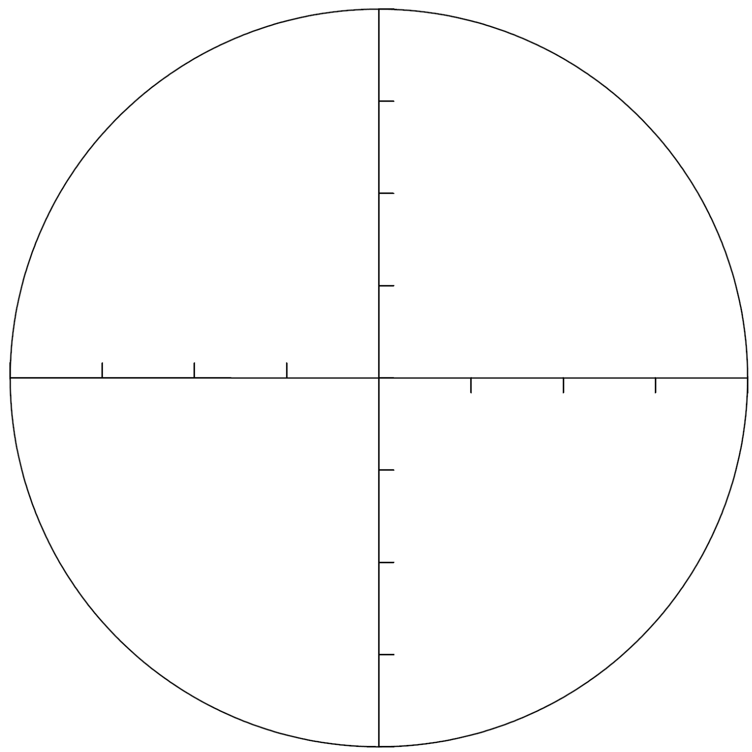
Specifying the Direction for Radial Axis Tick Marks for Each Pair of Radial Axes

To specify the direction for radial axis tick marks for each pair of radial axes:

1. Double-click a radial axis to open **Graph Properties**.
2. Under **Current**, select **Radial Data** from the **Axis** drop-down list.
3. Select either **Axis > Major Ticks** or **Axis > Minor Minor** from the **Properties** list.
4. Use **Direction** options to change the tick directions on the radial axes. You can only change the directions for Spokes 1 and 3 together, and for 2 and 4 together.

> **Remember:**
> Selecting **Inward** orients the ticks clockwise, and **Outward** points the ticks counterclockwise.

Figure 104. A Polar Plot with Ticks for Spokes 1, 3 Pointing Inward and 2,4 Outward



5. Selecting **Both** directions draws ticks both clockwise and counterclockwise, and selecting **(none)** hides the tick marks.

Modifying Ternary Axes

Ternary axes are drawn to represent increases in data value in a counterclockwise direction by default. You can reverse the axis direction, which is indicated by a reversal of tick labels. The tick direction changes accordingly.

Because ternary axes are interdependent, any modification in the scale type or range of one of the axes is reflected in the other axes, and may alter the shape and size of the graph. You can modify the color and thickness of axis lines, the appearance of tick marks and tick labels, location and rotation of axis titles, and display of each ternary axis independently.

Ternary axes can be modified similarly to other graph axes.

Restriction:

You cannot create axis breaks for ternary axes.

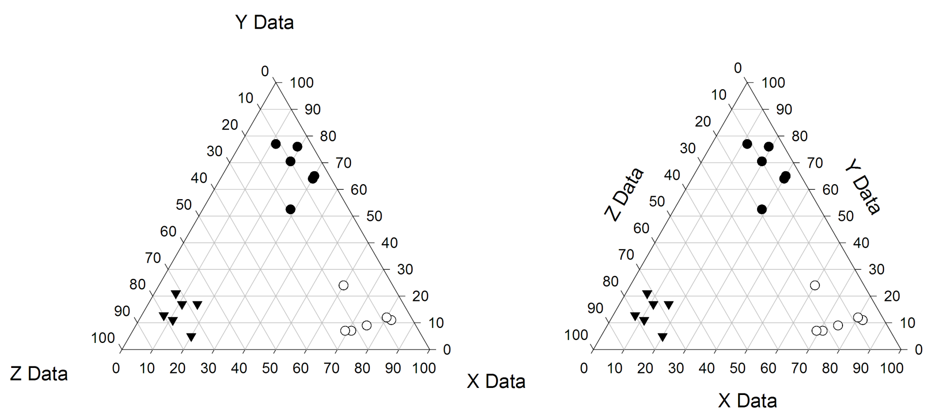
Modifying Ternary Axis Title Location

You can position axis titles of ternary graphs either at the apex or along the length of the axis. You can also rotate them to a position parallel to the axis.

To reposition a ternary graph axis title:

1. Select the axis.
2. In the pop up menu that appears, select a degree of rotation from the **Rotation** drop-down list.

Figure 105. The titles along the axes are also rotated with the axes.



Changing Ternary Axis Range, Scale, and Direction

Ternary axis scale type and range settings control the units and increments used to plot the data. Axis scale, range, and direction are modified using the Scaling settings displayed in Graph Properties. Axis range can also be modified by dragging a selected axis. Modifying a ternary axis range can alter the size and even the shape of the graph.

Modifying Axis Range by Dragging

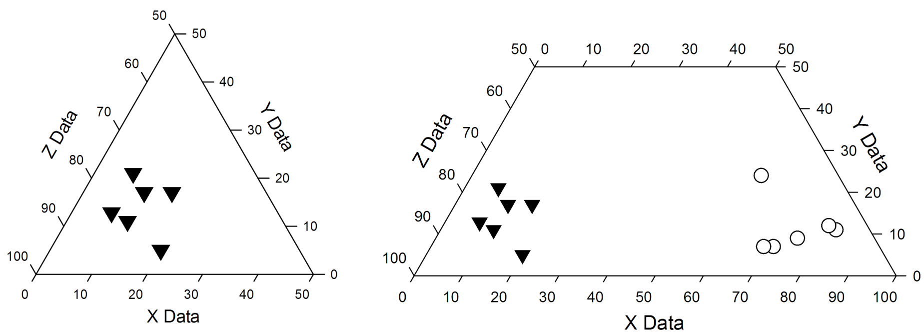
You can modify axis range by dragging a selected axis or apex. Because ternary axes are interdependent, dragging an axis to modify its range can change the ranges of the other axes.

Dragging an apex modifies the ranges of the two axes which form the apex; reducing the maximum of an axis range introduces a fourth axis, creating a trapezoid graph. Dragging a selected axis toward or away from the center of the graph modifies all three axis ranges by the same increment, maintaining the original shape of the graph.

To modify ternary axis ranges:

1. View the ternary graph.
2. Select either an apex or an axis to modify. A selected apex displays a black, square selection handle and is surrounded by a dotted line; a selected axis displays a selection handle at the center point of its range and is surrounded by a dotted line.

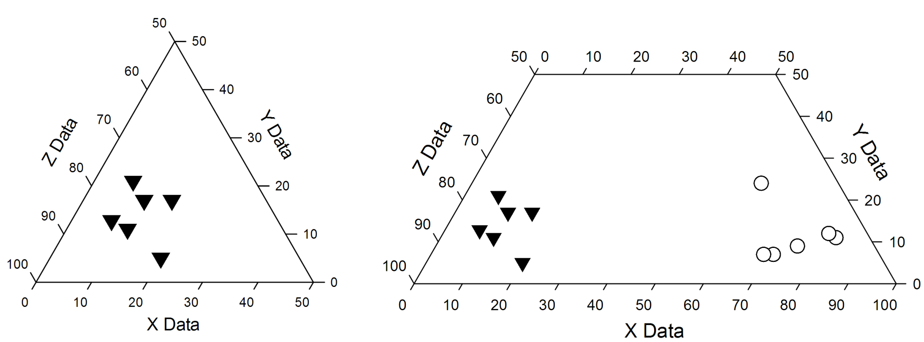
Figure 106. Dragging an Axis to Rescale a Ternary Plot Range



3. Drag either the apex or the axis toward or away from the center of the graph. The axis ranges adjust accordingly.

> **Note:**
> Modifying axis ranges of ternary graphs often introduces additional axes. These axes are the second axes of each "pair" of axis lines. An axis which appears as a result of moving an apex is paired with the axis opposite the apex which moved.

Figure 107. The left graph Y axis was dragged to 50%. The right graph Y apex was dragged to 50%.



Modifying Ternary Axis Range

Use Graph Properties to modify ternary graph ranges.

1. Double-click the axis to open **Graph Properties**.
2. Select **Axis > Ternary Scaling** from the **Properties** list.
3. **To change individual axis ranges,** under **X Range**, **Y Range**, and **Z Range** move the **Start** and **End** sliders.

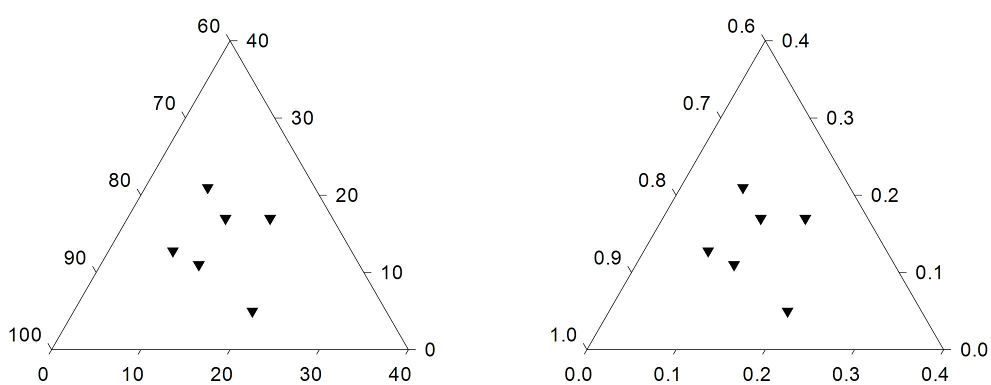
> **Tip:**
> Increasing an axis range minimum reduces the size of the ternary graph because it is always reduces the other axis range maximums. Reducing the maximum of a ternary axis range changes the graph shape.

Ternary Scale Type

All ternary axes on a single graph use either the default Percentage (0-100) scale or the Unitary (0.0-1.0) scale. Data used by each scale should be within the required ranges for each scale.

The type of graph you create determines the graph scale. There should be no need to change the scale unless a mistake was made while creating the graph. Changing the scaling from **Percentage** to **Unitary** can also hide out-of-range data.

Figure 108. The data range used for Percentage is 0-100; the data range for Unitary data is 0-1.



To change ternary axis scale type:

1. Double-click the ternary axis to open **Graph Properties**.
2. Select **Axis > Ternary Scaling** from the **Properties** list.
3. Select the new axis scale type from the **Scale type** drop-down list.

   When you change the axis scale type for one axis, it is changed for all axes.

Changing Ternary Axis Direction

Ternary graph axes show data increasing in either a clockwise or counterclockwise direction. Each axis line can represent either or both of two values in the graph. Changing the direction changes which values are shown on the axis by default. Modifying axis direction changes all three axes; ternary axes are interdependent.

Ternary graph axes have interdependent axis ranges from 0 to 100, where 0 to 100 is the default setting or 0-1.0 where 0-1.0 is the default setting.

The axis range and scale control the axis units and increments used to plot data.

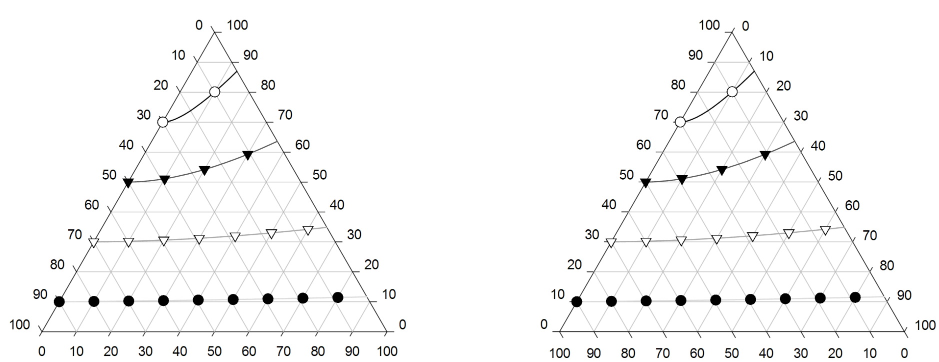
To modify the axis direction:

1. Double-click the ternary axis to open **Graph Properties**.
2. Select **Axis > Ternary Scaling** from the **Properties** list.
3. Select the axis direction from the **Direction** drop-down list.

   The tick directions change on all three axes and the axis ranges reverse.

   Changing the axis directions inverts the 0-100 direction of the labels and changes the direction of the tick marks. However, axis titles only move if they are positioned along an axis, not at an apex. Apex position for each variable remain constant regardless of axis direction.

   Figure 109. Ternary Graphs Displaying Counterclockwise (Left) and Clockwise (Right) Axis Directions



Changing Ternary Axis Tick Marks and Tick Labels

Ternary axes tick marks indicate the precise location of each value at specific intervals determined by the axis range. Tick marks and tick labels along ternary axes have both direction and origin. Every tick location can have tick marks and labels pointing in clockwise, counterclockwise, both clockwise and counterclockwise, and perpendicular directions, independent of the actual direction of the data.

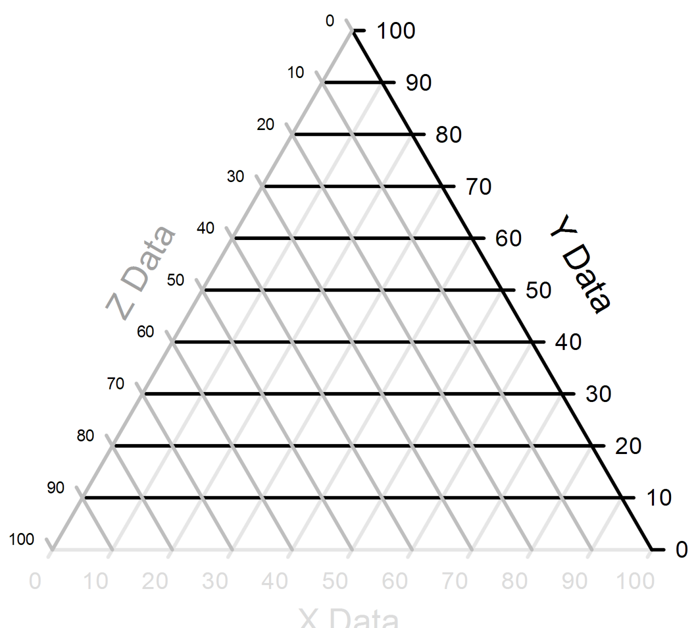
Tick and Tick Label Directions and Ownership

Tick marks and labels indicate which values correspond to the plotted data points by the direction they lean in. The direction also indicates which axis the tick is actually controlled by. This can be a different axis than the tick mark is actually drawn on.

For example, the default ticks for the X axis are drawn leaning in a clockwise direction on the bottom axis. These tick marks also correspond to the counterclockwise tick marks on the Y axis. If you change the tick mark attributes for X axis ticks, you can affect tick marks that are actually drawn on a different axis.

The following figure best illustrates tick mark and label ownership.

Figure 110. The X Axis ticks and labels are drawn in light gray, the Y Axis ticks and labels are drawn in black, and the Z Axis ticks and labels are drawn in dark gray.



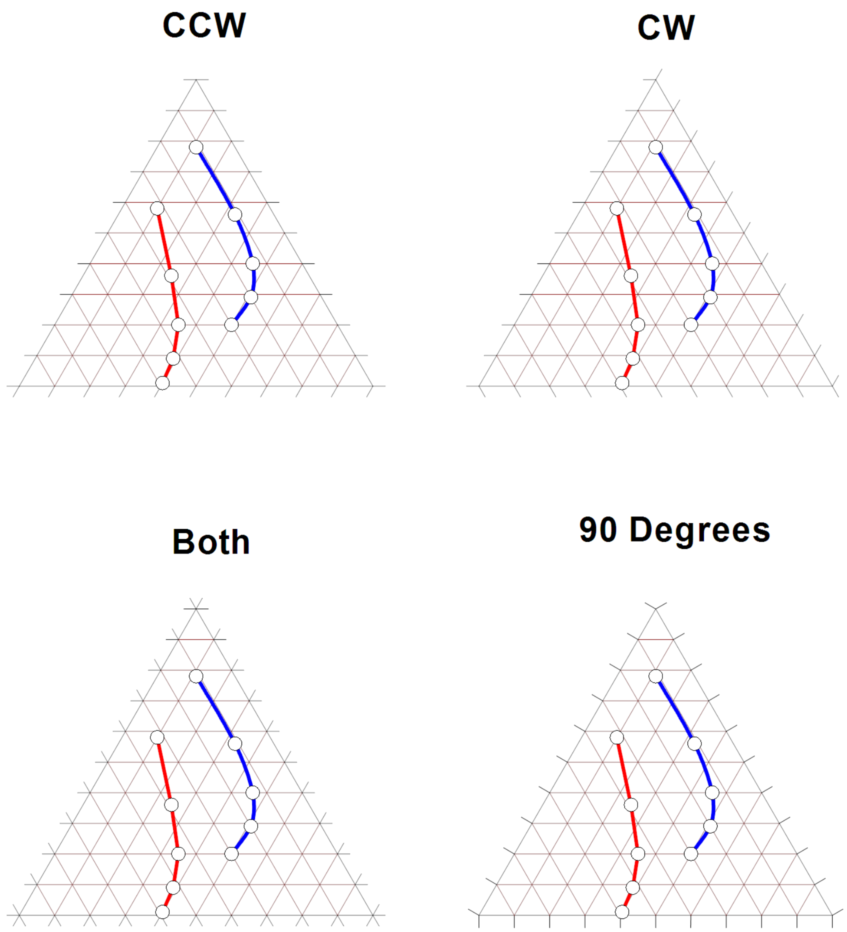
Modifying Ternary Tick Marks Direction and Intervals

Use Graph Properties to modify tick appearance including tick length and color. You can also specify to view or hide tick marks, which side of the axis they extend from, and the tick interval.

To modify tick marks:

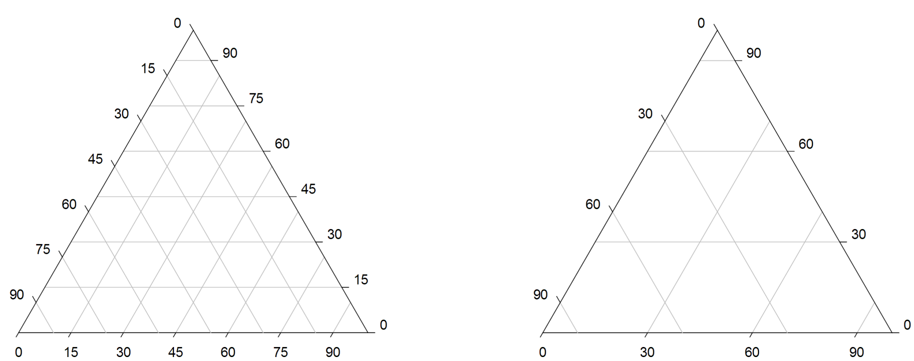
1. Double-click the ternary axis to open **Graph Properties**.
2. Select either **Axis > Major Ternary Ticks** or **Axis > Minor Ternary Ticks** from the **Properties** list.
3. **To turn tick drawing on and off and to select tick directions for both sides of an axis line,** use the **Direction** lists. The second list is only available if a ternary plot range change has created a secondary axis.
4. Select **Out**, **In,** or **In and Out** to display tick marks on the selected axis out from the center of the graph, in toward the center of the graph, or both outward and inward. Select a **clockwise**, **counterclockwise**, **both**, or **90 Degree** option to select the tick mark direction along the axis. Select **(none)** to hide tick marks.

Figure 111. Graph Examples of Tick Marks Pointing, counterclockwise, Clockwise, Both, and 90 Degrees



5. **To change tick intervals,** under **Tick intervals**, move the **Major ticks every** or **Minor ticks every** slider.

Figure 112. Ternary Graphs with Tick Intervals of 15 and 30



Modifying Ternary Tick Mark Line Appearance

To change tick mark display, length, color, and interval:

1. Double-click the ternary axis to open **Graph Properties**.
2. Select either **Axis > Major Ternary Ticks** or **Axis > Minor Ternary Ticks** from the **Properties** list.
3. **To change tick thickness,** under **Tick lines**, move the **Length** and **Thickness** sliders. Drag the slider control with the mouse or set the tick length and thickness to specific values by typing directly in the **Length** and **Thickness** boxes.
4. **To change tick color,** under **Tick lines**, select a color from the **Color** drop-down list. Choose from any of the listed colors, or select **(Custom)** to use a pre-defined custom color or create your own color. Select **(none)** to create transparent tick marks.

Modifying Ternary Tick Label Display

Tick labels are drawn using directions clockwise, counterclockwise, and both clockwise and counterclockwise. Tick label direction is controlled independently of the data direction. Tick labels can also be turned off, have a prefix or suffix added, and be rotated along the angle of the axis line.

You can also modify the tick label.

To modify tick label display along an axis:

1. Double-click the axis you want to change to open **Graph Properties**.
2. Select either **Axis > Major Ternary Labels** or **Axis > Minor Ternary Labels** from the **Properties** list.
3. **To change the direction of the axis tick labels,** under **Major (or Minor) tick labels**, select **Clockwise** and **Counterclockwise (CCW)**. You can draw in both directions at once.
4. **To draw tick labels at the 90 degrees tick position,** clear both direction options.
5. **To add a suffix or prefix to the major or minor tick labels on ternary axes,** under **Add to major (or minor) tick labels** type a prefix or suffix..
6. **To rotate major or minor tick labels parallel to their axis,** under **Rotate with axis**, select **Axis title** or **Tick labels**.

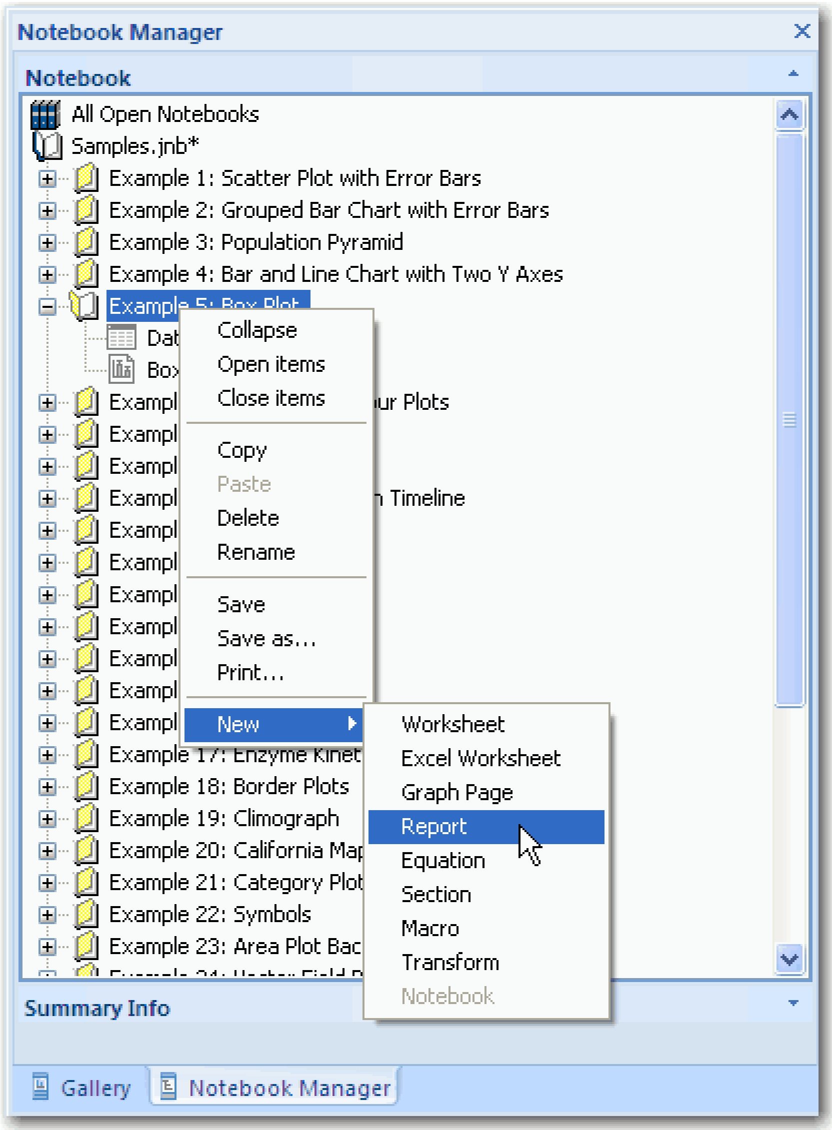
Chapter 8. Using the Report Editor

Use the Report Editor to annotate and document your graphs and data. The Report Editor features a complete text editor and OLE2 insertion and editing. It is also used by the Regression Wizard to report regression results and by the Statistics Wizard to report statistics test results.

Creating Reports

To create a new report:

Right-click the section in the notebook where you want to create the report, and on the shortcut menu click **New**.
A report window opens and a new report is added to the selected section.



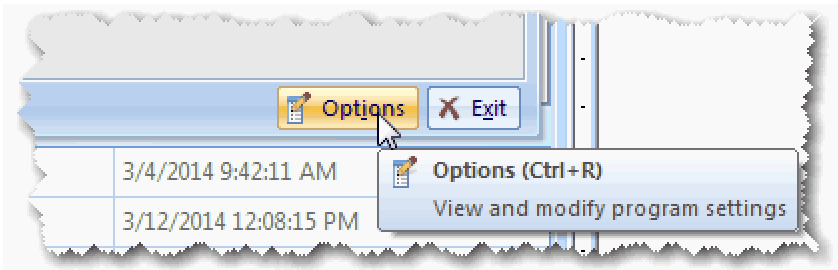
Setting Report Options

Use the **Reports** tab on the **Options** dialog box to:

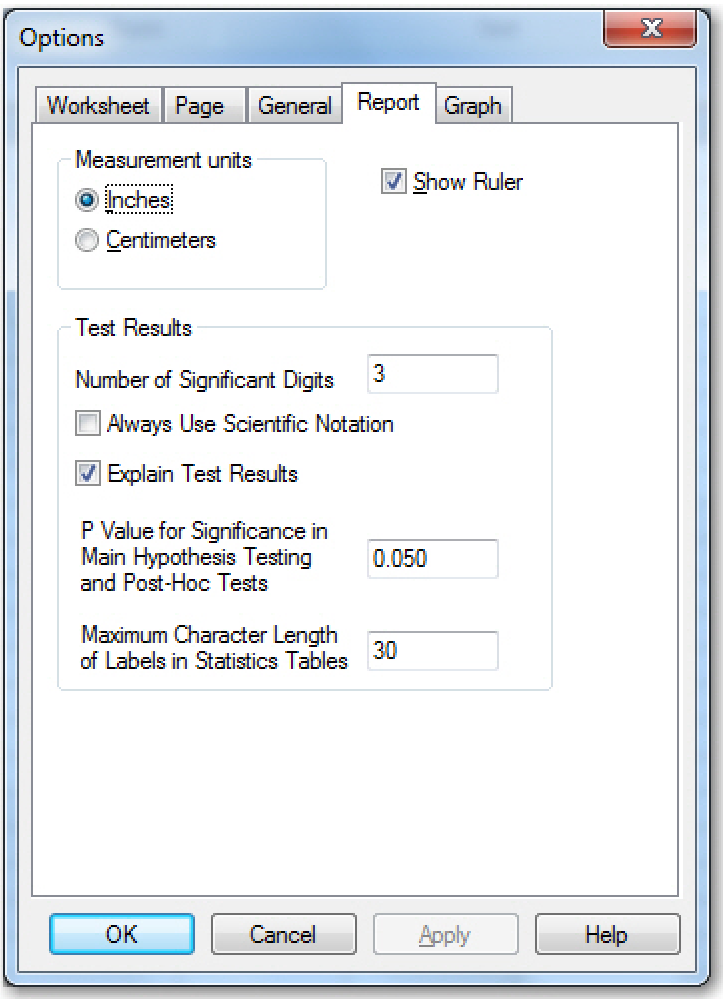
- Set the number of decimals displayed in the report.
- Enable or disable scientific notation.
- Enable or disable explanatory text for report results.
- Set whether or not you want to report only flagged values.
- Hide or display the report ruler.
- Set measurement units.
- Save or not save result graph data with reports.

To set report options:

1. Click the **Main Button**.
2. Click **Options**.



3. Click the **Report** tab.



4. **To set the number of significant digits used for the values in the report,** select **Number of Significant Digits**. The default is three digits. The maximum number of digits is sixteen.

5. **To use scientific notation for the appropriate values in the report tables,** select **Always Use Scientific Notation**. If this option is disabled, scientific notation is only used when the value is too long to fit in the table cell. This option is disabled by default.
6. **To explain explanatory text for test results in the report,** select **Explain Test Results**. This option is enabled by default. Clear this option to keep explanatory text out of the report.
7. **To specify a significant P value,** select **P Value for Significance**. This option determines whether there is a statistically significant difference in the mean values of the groups being tested. The value you specify is compared to the *P* values computed by all tests.

 > **Note:**
 > This *P* value does not affect the actual test results. It only affects the text that explains if the difference in the mean values of the groups is due to chance or due to random sampling variation.

 If the *P* computed by the test is smaller than the *P* set here, the text reads, "The difference in the mean values of the two groups is greater than would be expected by chance; there is a statistically significant difference between the input groups."
 If the *P* value computed by the test is greater than the *P* set here, the text reads, "The difference in the mean values of the two groups is not great enough to reject the possibility that the difference is due to random sampling variability. There is not a statistically significant difference between the input groups."
 One of the above explanation text strings appears for each *P* value computed by the test. ANOVAs and some regressions produce multiple *P* values.

 > **Remember:**
 > If the **Explain Test Results** option is cleared, the results of this *P* value do not appear in the report.

8. **To display the ruler at the top margin of the report page,** select **Show Ruler**. This option is enabled by default. Clear this option to hide the report ruler.
9. **To save report result graph data with reports,** select this option. This option is enabled by default. If storage space is an issue, clear this option.

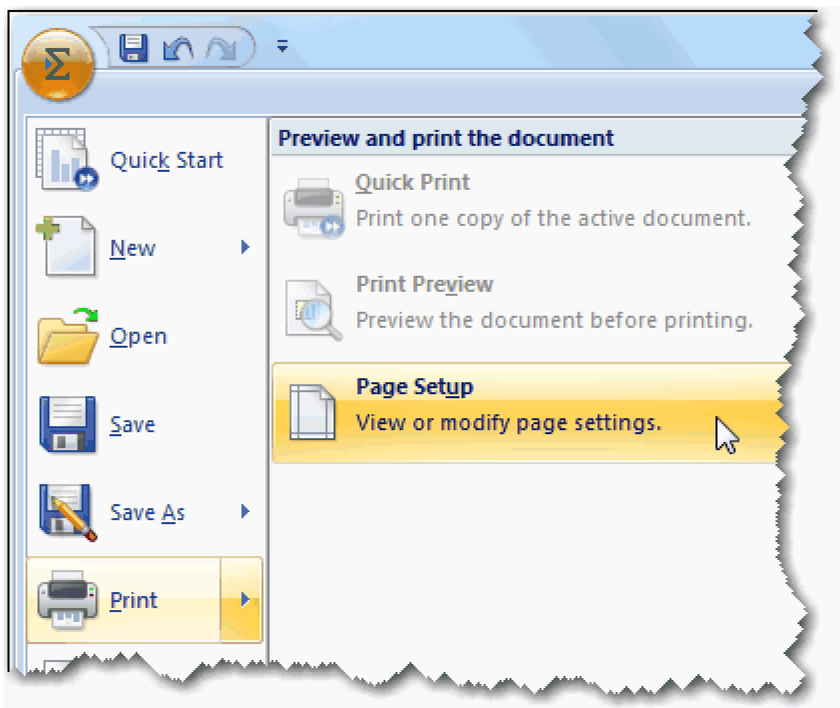
Setting Report Page Size and Margins

Use the report **Page Setup** dialog box to set report margins, paper orientation, paper size, and paper source.

Important:
These settings apply to the current report, but not to other open reports. To have these settings apply to subsequently opened or created reports, make your changes, then close the page. Newly opened or created reports will use all of these settings.

To open the Page Setup dialog box:

1. Select the report window.
2. Click the **Main Button**.
3. Click **Print**, and then **Page Setup**.



4. In the **Page Setup** dialog box, select the paper size and source from the **Size and Source** drop-down lists. The page sample at the top of the dialog box reflects changes.

5. **To select the printer,** click **Printer**. The **Page Setup** dialog box appears on which you can select and setup any printer configured for your system.
6. **To change the margins,** under **Margins (inches)**, type the desired values into the four boxes. The current ruler units appear in the **Margins** title.

Exporting Reports

You can only export the entire report. If you want to export a portion of the report, delete the portion you don't want to export, then export the remainder as the file.

To export a report:

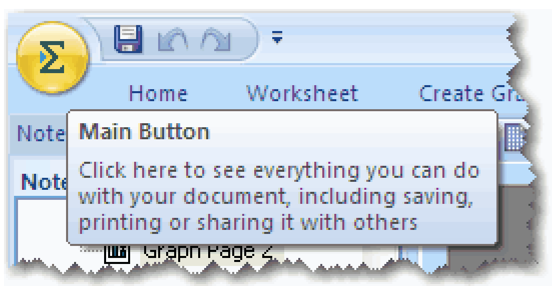
1. Select and view the report window you want to export.
2. On the **Home** tab, in the **Export** group, click **Report**.
3. In the **Export File** dialog box, from the **Files of type** drop-down list, select a file format.
4. Click **Export** to create the file.

Printing Reports

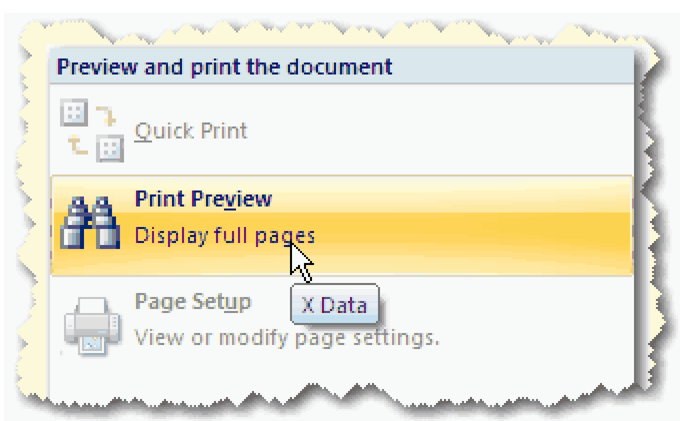
You can print any report in a SigmaPlot notebook.

1. To display a report as it will look when printed:

   a. Click the **File** tab**Main Button**.

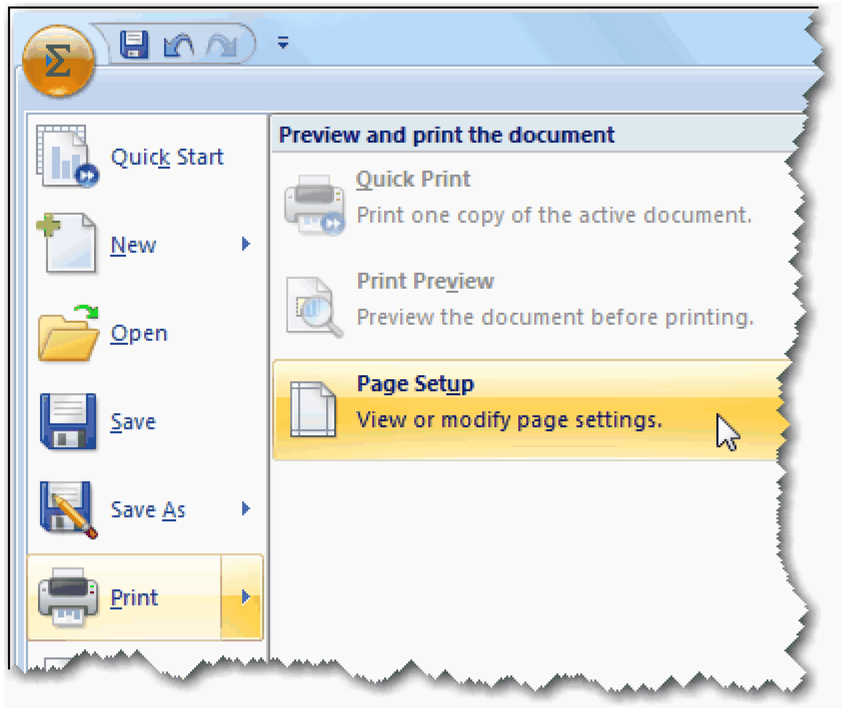
   b. Click **Print**, and then **Print Preview**.

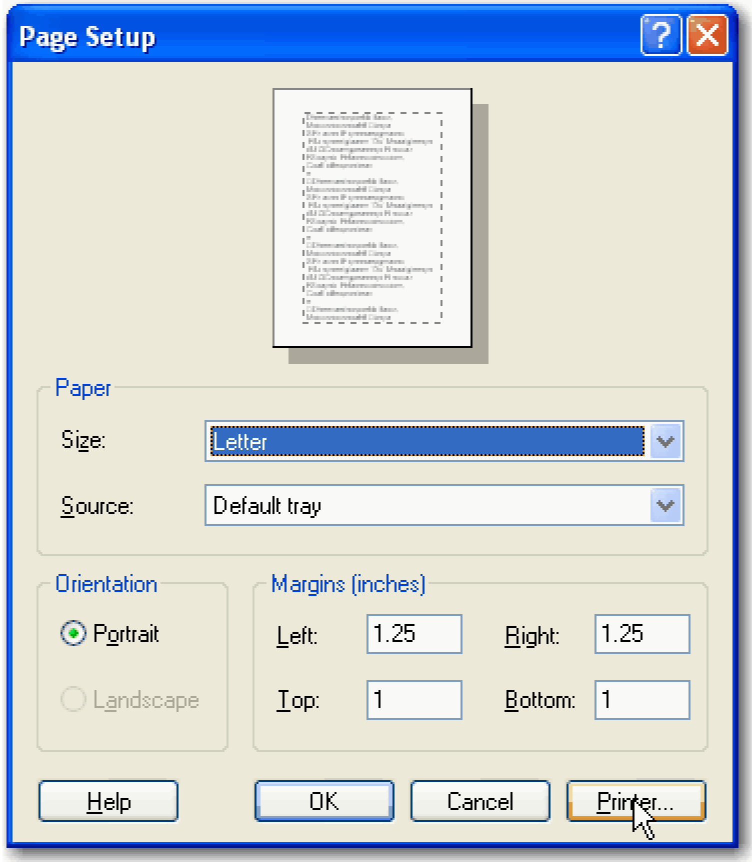
   c. Click **OK** to print the report.

2. To set printing options before printing the report:

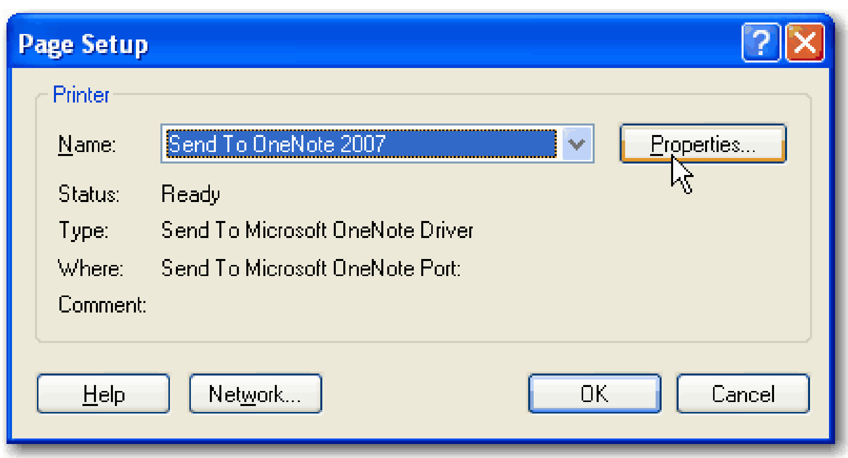
a. Click **Main Button > Print > Page Setup**.



b. In the **Page Setup** dialog box, click **Printer**.



c. In the next **Page Setup** dialog box, click **Properties**.



d. Click **OK** when you are satisfied with the printer properties settings.

Restriction:
The **Properties** dialog box options vary from printer to printer.

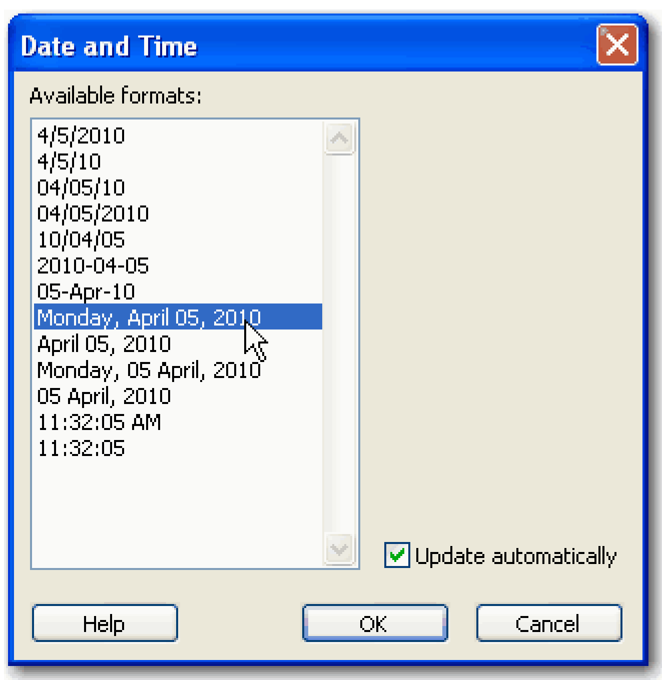
e. Click **OK** to print the report.

Inserting the Current Date and Time into a Report

To insert the current date and time into reports:

1. Select the report and click where you want to insert the Date or Time.
2. On the **Report** tab, in the **Insert** group, click the **Insert** drop-down list.

3. Click **Date and Time**.
4. In the **Date and Time** dialog box, select the date and time format from the **Available formats** list.



5. Click **OK**. The current date and time appear as text at the specified location.

> **Important:**
> The list of available date and time formats depends on your Regional Settings. You can view or modify the **Regional Settings** directly from your **Windows Control Panel**.

Formatting Text and Paragraphs

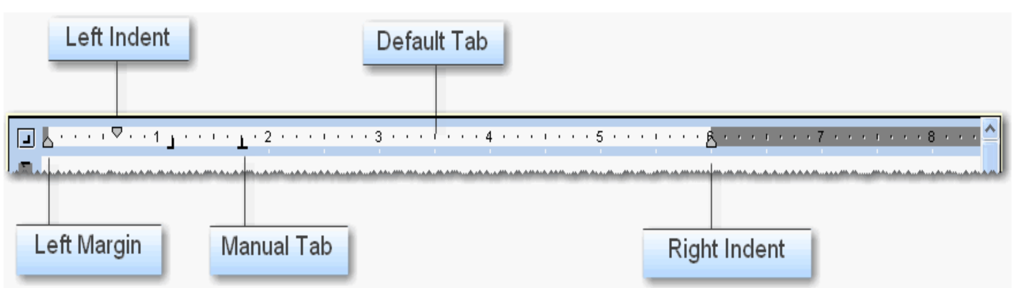
To modify text:

1. Select the text you want to modify. You can select individual characters, words, paragraphs, or the entire report.
2. **To format character font, size, weight, underlining, or color**, . For more information, see Editing Text *(on page 183)*.
3. **To set paragraph alignment,** select **Align Left**, **Align Center**, and **Align Right** and **Justify**.
4. **To add bullets or numbers a to selected paragraph,** select the **Bullet Style** or **Number Style** .
5. To remove bullets, click the **Bullet Style** or **Number Style** again.

Using the Report Editor Ruler

Use the Report Editor ruler to view margins and to both view and modify report page tabs and paragraph indents.

Figure 113. The Report Editor Ruler



The ruler indicates:

- Usable page column width
- Default tabs
- User-defined tabs

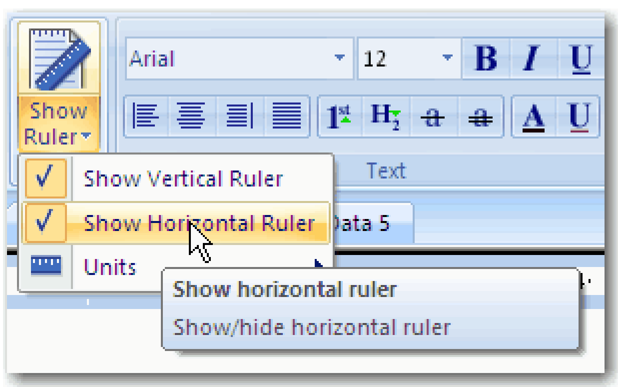
- Left and right paragraph indents
- First line indent

Showing and Hiding Report Rulers

To show or hide horizontal and vertical rulers:

1. On the **Report** tab, in the **Ruler** group, click the **Show Ruler** drop-down list.

2. Click **Show Vertical Ruler** and **Show Horizontal Ruler**. A check mark means the ruler is visible. Clear it to make the ruler invisible.



Setting Report Ruler Units

You can set the horizontal and vertical ruler units in SigmaPlot reports to either Inches or Centimeters.

1. On the **Report** tab, in the **Ruler** group, click the **Show Ruler** drop-down list.

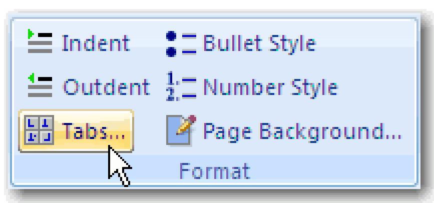
2. Click **Units** and then either **Inches** or **Centimeters**.

Setting Tabs

All tab stops appear on the report ruler. The default tab stop is 0.25" regardless of the current units. Tab stops are made for individual and selected paragraphs, and are saved with reports.

To set a tab:

1. Select the paragraph(s) to change the tab stops.
2. Click the ruler where you want to place a tab. A tab marker appears at the clicked location.
3. **To move a tab,** drag the tab marker to another location on the ruler. To delete a tab, drag the tab marker off the ruler.
   You can also set tabs from the **Tabs** dialog box.
4. On the **Report** tab, in the **Format** group, click **Tabs**.



5. In the **Tabs** dialog box, select tab stops from the **Tab position in inches** drop-down list.

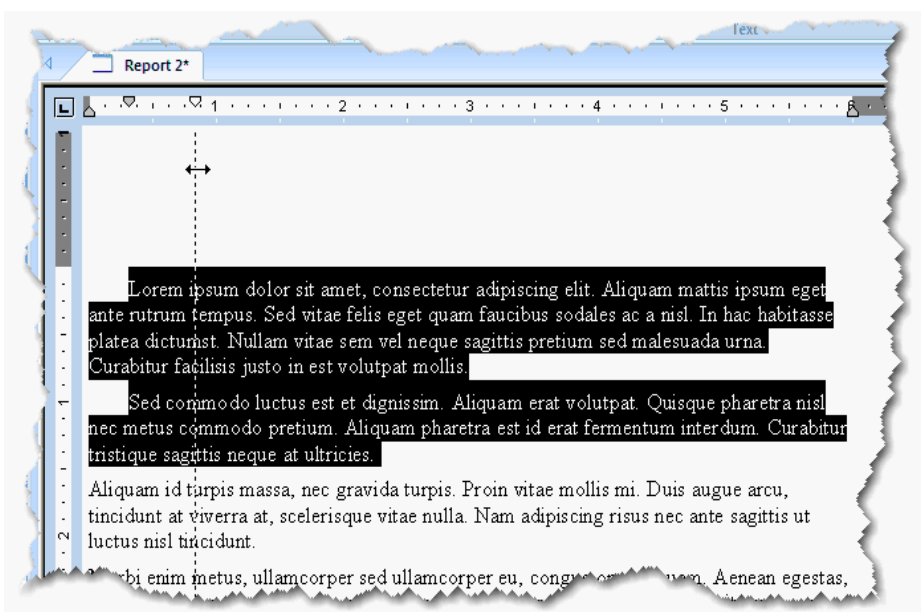
6. Enter Tab locations using the current ruler units.
7. Click **OK** to add the tab setting to the list.

Setting Paragraph Indents

You can set left, right, and first line indents for individual paragraphs. These settings are saved with the report.

To set paragraph indents:

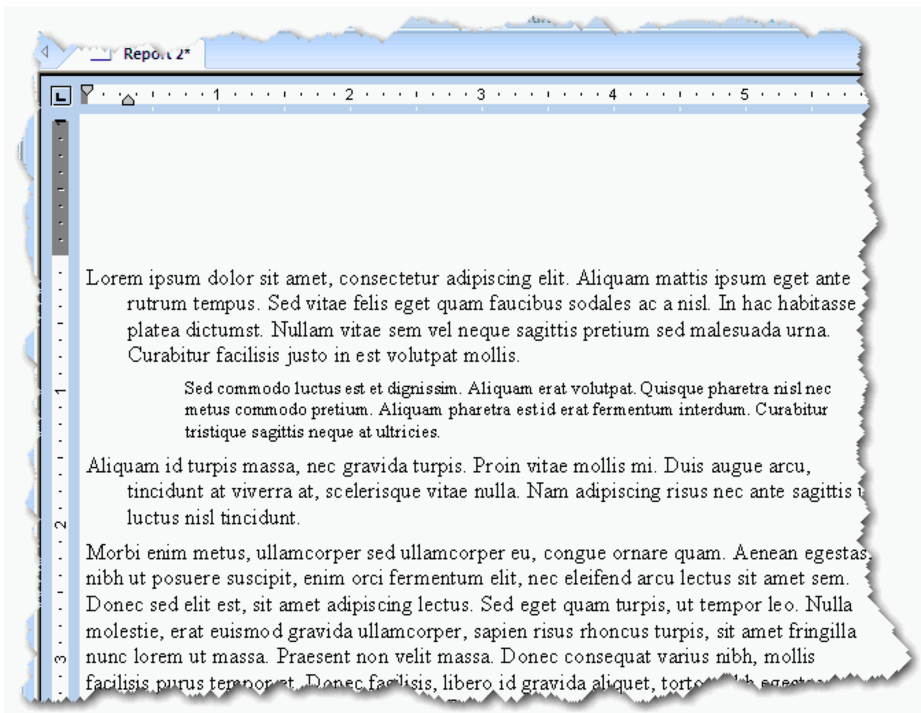
1. Select the paragraph(s) to change the indents.



2. **To change the first line indent,** drag the marker at the top left of the ruler.

3. **To change the left indent,** drag the marker on the bottom left of the ruler.
4. **To move both the left and first line indents,** drag each marker separately.
5. **To change the right indent,** drag the marker on the bottom right side of the ruler.

> **Tip:**
> To create an indented line, drag the top left marker to the right of the left indent.
> To create a hanging indent, drag top left marker to the left of the bottom left indent marker.



Adding Tables to Reports

1. In the report, click where you want the report to appear.
2. Select **Report > Insert > Table**.On the **Report** tab, in the **Tables** group, click , and then click **Insert Table**.
3. In the **Insert TableNew Table Parameters** dialog box, select the number of rows and columns you'd like to appear in the table.

Changing Table Border Color

Deleting Cells, Columns, and Rows from Tables

1. Select the cell, column, row, or block of cells in the table that you'd like to delete.
2. Right-click, and on the shortcut menu, select .
   You can also select the entire table and press Delete.

Adding Rows to Report Tables

1. Click on a cell in a table above or below where you'd like the new row to appear.
2. On the **Report** tab, in the **Tables** group, click the **Rows** drop-down list.
3. **To add a row above the cell,** click **Insert rows above**.
4. **To add a row below the cell,** click **Insert rows below**.

Adding Columns to Report Tables

1. Click on a cell in a table to the left or to the right of where you'd like the new column to appear.
2. On the **Report** tab, in the **Tables** group, click **Columns** drop-down list.
3. **To add a column to the right of the cell,** click **Insert columns to the right**.
4. **To add a column to the left of the cell,** click **Insert columns to the left**.

Chapter 9. Publishing Graphs

You can use SigmaPlot to publish graphs on the World Wide Web, and to create publication quality graphs for submission to journals and other printed forms.

Publishing Graphs on the World Wide Web

You can save your graphs in high resolution and then later publish them on the Internet using the SigmaPlot WebViewer. For more information, see About the SigmaPlot WebViewer *(on page 377)*.

Saving your graphs as a web page creates HTML code that you can later import into any HTML editor.

About the SigmaPlot WebViewer

The SigmaPlot WebViewer is an ActiveX control freely distributed from the Systat Web site. If this control is not installed the first time a SigmaPlot graph is viewed on a web page, the WebViewer is automatically installed. Then you can view the graphs in high resolution on the Intranet or Internet.

Using the SigmaPlot WebViewer, you can:

- View the graphs in high resolution.
- Pan and zoom the graph without losing resolution.
- Print in high resolution (printer resolution) as opposed to typical Web graphics (GIFs, JPEGs, etc.) that are printed in low resolution.
- View the data used to create the graph.

Exporting Graphs into HTML Format

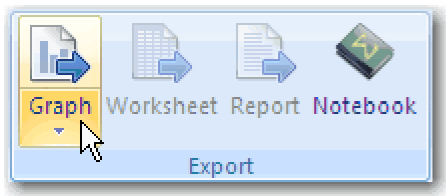
When you export a graph to the Web, SigmaPlot automatically creates three files:

- A notebook .JNB file which contains the SigmaPlot graph and data worksheet.
- A .JPG of the graph, viewable by those who do not have the SigmaPlot WebViewer.
- An .HTM file which references a .JPG of the graph and the .JNB file.

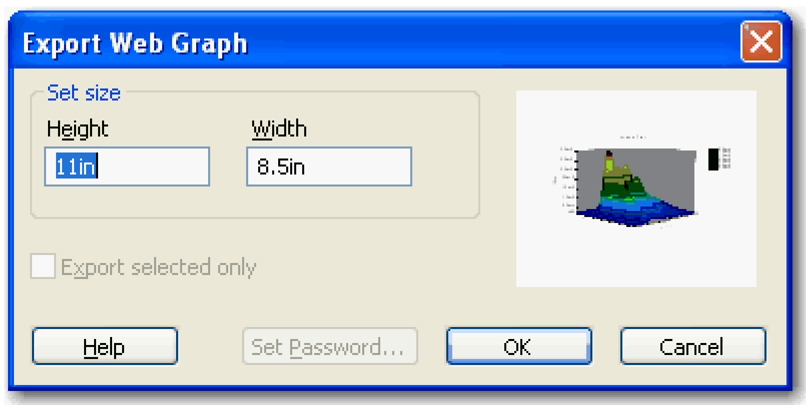
You can export an entire graph page or other pasted objects.

To export a SigmaPlot graph into HTML format:

1. Open a graph page.
2. Select the page objects you want to publish.
3. On the **Home** tab, in the **Export** group, click the **Graph** drop-down list.



4. Click **Save as Web Page**.
5. In the **Export File** dialog box, enter a name of the file in the File name box.
6. Click **Export**.



7. **To set the size of the figure,** in the **Export Web Graph** dialog box, select desired measurements from the **Height** and **Width** drop-down lists.

> **Tip:**
> One inch is 96 pixels, and the aspect ratio **Export Web Graph** dialog box uses is fixed.

8. **To export the currently selected graph or objects**, select **Export Selected Only**.
9. **To export the entire graph page,** clear **Export Selected Only**.
10. **To password protect the file,** click **Set Password**.
11. Click **OK**.

    Three files are created: an .HTM file which references a saved JPG file, and a JNB file. You can later insert this .HTM file into any HTML editor.

Password Protecting Data on the World Wide Web

You can secure your data for a graph you export to an HTML file by setting a password for viewers to enter when viewing this graph on the Internet. Setting a password also prevents the opening and downloading of this file.

To set a password:

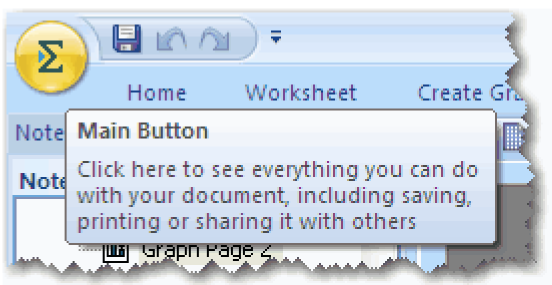
On the **Export Web Graph** dialog box, click **Set Password**. The **Set Password** dialog box appears.

Exporting Data Associated with the Graph

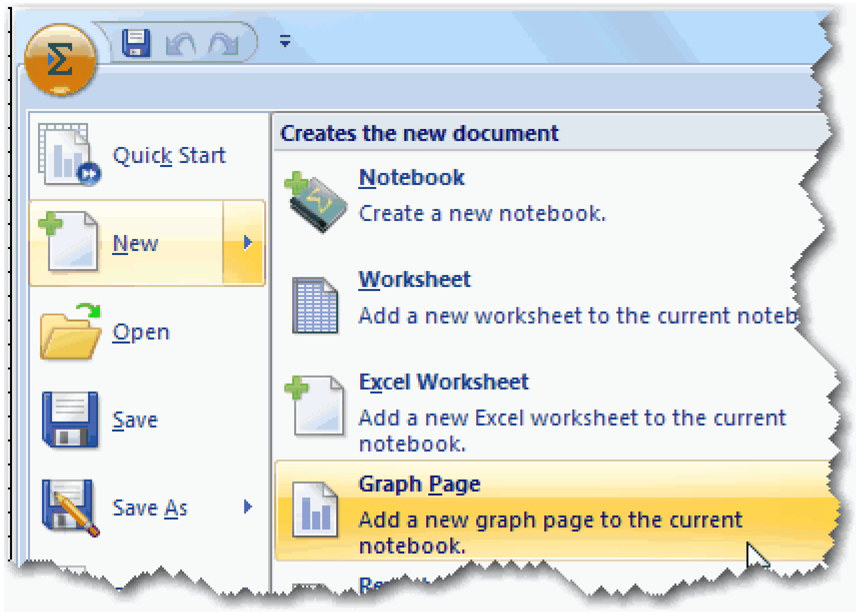
When you export a graph to a web page, you not only export the data for the graph but the entire worksheet as well. This can be useful if you want to associate or display additional data for the graph, but it can also increase the size of the JNB file, which can slow viewing.

To export just the data associated with the graph:

1. Select the graph on the page, and copy it.
2. Click the **Main Button**.



3. Click **New > Graph Page**.



4. Click **No** on the **Graph Page** dialog box.
5. Paste the graph to the new page.

   Now when you export this graph, you will also only export the data associated with the graph.

Submitting Graphs for Publication

The following are some guidelines for preparing graphs for submission to journals or other printed form. This process is not necessarily simple, and requires understanding both the figure requirements of the publication as well as graphic file formats and terminology.

Figure Submission Requirements

The ultimate destination for most SigmaPlot graphs is a publication, and most publishers are now equipped for digital pre-press. This requires graphic files with specific formats and properties. Keep in mind the requirements of the different journals and other publications. These tend to vary, but are usually available at the web site for the journal submission requirements.

Some URLs (as of the writing of this document) for requirements for some major publications are:

- Nature: https://www.nature.com/nature/for-authors/initial-submission
- Science: https://cts.sciencemag.org/scc/#/login
- The Proceedings of the National Academy of Sciences: https://www.pnas.org/author-center
- Journal of the American Chemical Society: https://publish.acs.org/publish/

Many journals also use the Cadmus electronic prepress service. Their requirements can be found at: https://www.cadmusjournal.org/node/82.

Creating Files for Figure Submission

The steps to producing a file for publication can vary from publisher to publisher. For more information, see Figure Submission Requirements *(on page 380)*.

When preparing a figure for file export, first determine:

- The final size of the figure, including the size of text (usually inches or millimeters).
- The required line weights.
- Acceptable typefaces (especially important for EPS (Encapsulated Postscript) files).
- The desired final dpi (the dots-per-inch resolution), if necessary.

To produce a file for publication:

1. Determine the final size of the figure, the heights of text and thicknesses of lines and whether the figure will be color, grayscale, or black and white.
2. Determine what file formats are acceptable, and choose the best one. The ranking in which you should choose your format is:
    - SigmaPlot
    - EPS
    - TIFF
3. Printed hardcopy (not really a file, but some publications actually still prefer this).
   These formats are regardless of whether the graph is color or not.
   Some publishers will directly accept SigmaPlot files. Most others accept EPS, TIFF, or both.
4. Determine how much the figure is going to be scaled using the size of your current figure. For example, if your graph is 5 inches wide, but the figures are printed at 3.25 inches wide, then scale your graph by a factor of 3.25/5, or .65.
5. Increase text labels and line widths accordingly on your SigmaPlot graph.
   For example, if you reduce your graph to .65 of the original size, and text must be 10pt in height, increase your labels to at least 15.5pt.
   Alternately, you can reduce the graph itself to the final publication size.
6. Make any other changes to your graph to meet the publisher's requirements, such as typeface, labeling, and so on.
7. Once you have your graph formatted, produce the selected file. Make sure that you select the figure (click it) before choosing export-this will automatically crop your figure for you.

If you are producing an EPS file, you don't need to pay attention to dpi at all.
If you must use TIFF format, make sure you use the CMYK-compressed TIFF format. Uncompressed TIFF files are too big to easily handle. Also, you will now have to do some dpi calculations.
For example, if you are producing a file that requires a final printed dpi of 600, and the graph is being reduced by a .65 ratio, do not set the file dpi to 600. Instead, use a dpi of 390 (600*.65). When this file shrinks to the final printed size, the final dpi will also be 600.

Why Use EPS?

Most publishers request either EPS or TIFF formats. When given a choice, choose EPS. Why? Because EPS is known as a vector format. This means that the image is not made up of pixels, but instead graphic descriptions of lines, fills, text, and so on. A vector format has no "size." It is dimensionless. This means you can shrink it as small as you want, or grow it as big as you want, with no change in resolution. dpi has no meaning for a vector file.

This format is ideal for a graph figure since there is no degradation of the quality of the figure as it re-scales. It is also means that when you place a vector format file in a document, it often first appears at an arbitrary size, and then you can scale it to the final desired size. This can often startle, annoy or confuse someone not familiar with the behavior of vector files.

The other vector format supported by SigmaPlot is the Windows Enhanced Metafile format.

Restriction:
Be aware SigmaPlot does not support certain graphic features in the EPS format, such as anti-aliasing, gradient fills, and partial color transparency; however, the Enhanced Metafile format does support these features.

About dpi

dpi (dots per inch) is a printer term, and is often misleading. dpi determines how many pixels are used to create the figure. A more accurate term would be resolution. You can increase the final dpi of a raster figure by shrinking it. This creates more pixels within a smaller space, increasing the dpi.

Most printed figures do not require a dpi higher than 600 for grayscale figures, and 300 dpi for color figures. The 1200 dpi number is for black and white figures only that have no half toning. If you must produce a 1200 dpi figure, you will have to do some post-processing on your file in order make it palatable to the printer. This can be beneficial if you must use TIFF file and have Photoshop.

The Submission Assistant

The Submission Assistant walks you through the sometimes arduous process of creating graphs suitable for publication. Choose from a list of journal profiles that correspond to specific journal submission requirements, or create and edit your own profiles. If you run into any problems along the way, the Submission Assistant offers suggestions to get your graph publication-ready.

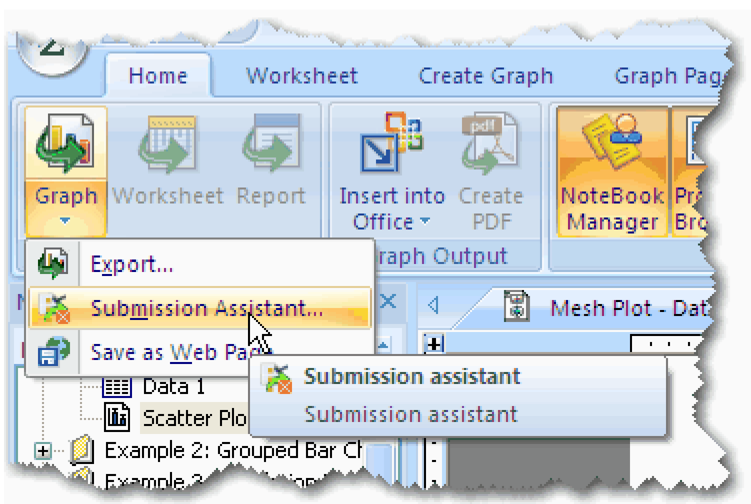
This section explains how to:

- Submit a graph using the Submission Assistant.
- Editing a submission profile.

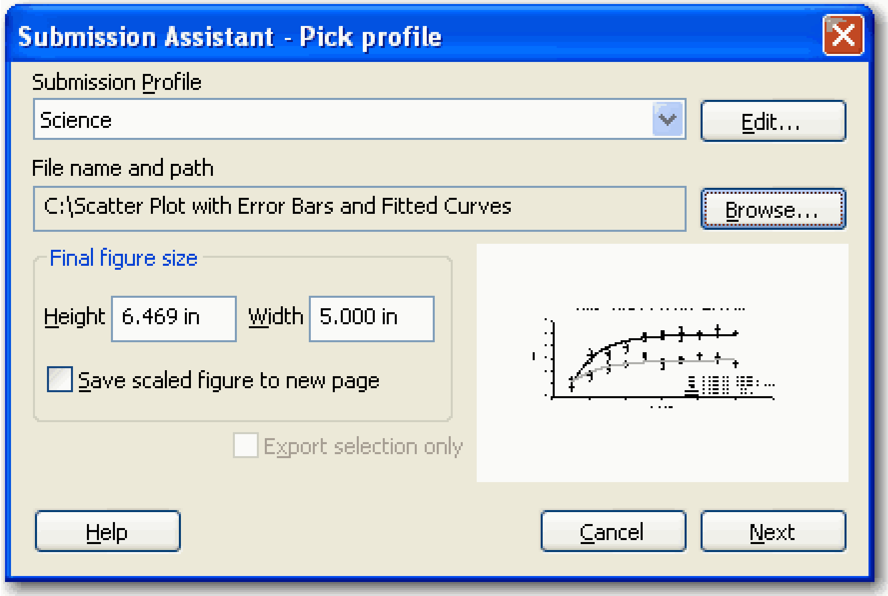
Using the Submission Assistant

To start the Submission Assistant:

1. On the **Home** tab, in the **Export** group, click **Graph**.
2. Click **Submission Assistant**.



3. Once the graph has met the Submission Criteria, click **Export**.
4. In the **Submission Assistant** dialog box, pick a journal profile from the **Submission Profile** drop-down list.



Note:
Profile data is stored by default in individual profile files in your User's Folder. For more information, see About SigmaPlot's User and Program Files *(on page 21)*

.

5. Enter the final figure size into the **Height** and **Width** fields. This is either set by default or you enter this information manually.
6. Once the graph has met the Submission Criteria, click **Export**.

Editing a Submission Profile

Use the **Submission Assistant - Pick profile** dialog box to modify the file type, figure size and minimum sizes for fonts and lines.

To edit a profile:

1. On the **Submission Assistant - Edit profile** dialog box, click **Edit**.
2. After you've edited the profile, click **OK** to save it.

Chapter 10. Automating Routine Tasks

SigmaPlot uses a VBA®-like macro language to access automation internally; however, whether you have never programmed, or are an expert programmer, you can take advantage of this technology by using the Macro Recorder. This chapter describes how to use SigmaPlot's Macro Recorder and integrated development environment (IDE).

This chapter also contains descriptions of related features accessible in the Macro window, including the Sax Basic programming language, debugging tool, dialog box editor, and user-defined functions.

Record a macro any time that you find yourself regularly typing the same keystrokes, choosing the same commands, or going through the same sequence of operations.

Before you Record a Macro

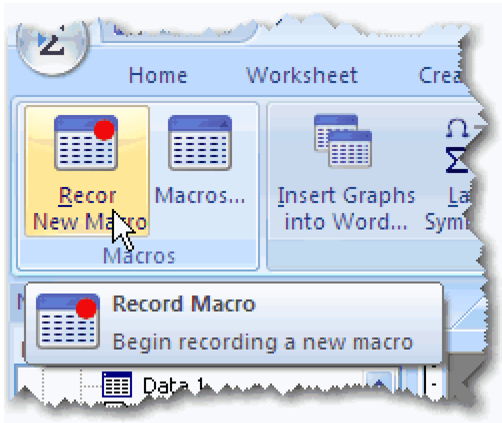
Before you record the macro:

- Analyze the task you want to automate. If the macro has more than a few steps, write down an outline of the steps.
- Rehearse the sequence to make sure you have included every single action.
- Decide what to call the macro, where to assign it, and where to save it.

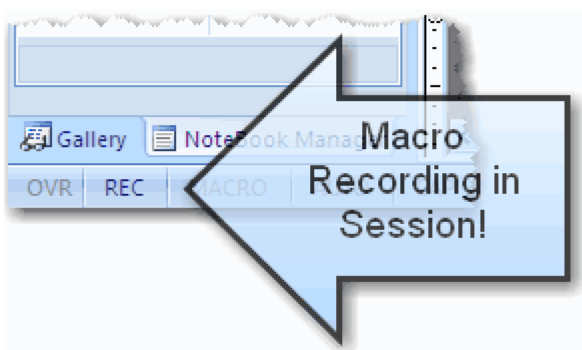
Recording Macros

To record a macro:

1. On the **Toolbox** tab, in the **Macros** group, click **Record New Macro**.



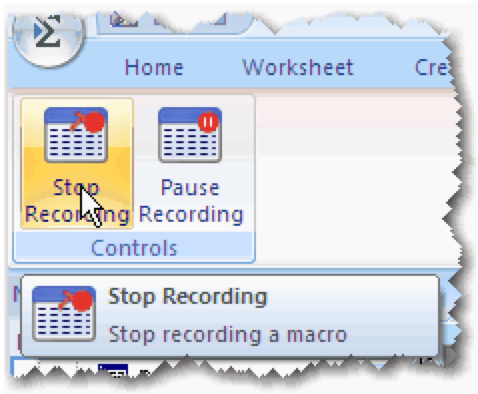
REC appears in the status area of SigmaPlot's main window, indicating that the macro is recording your tab selections and keystrokes.



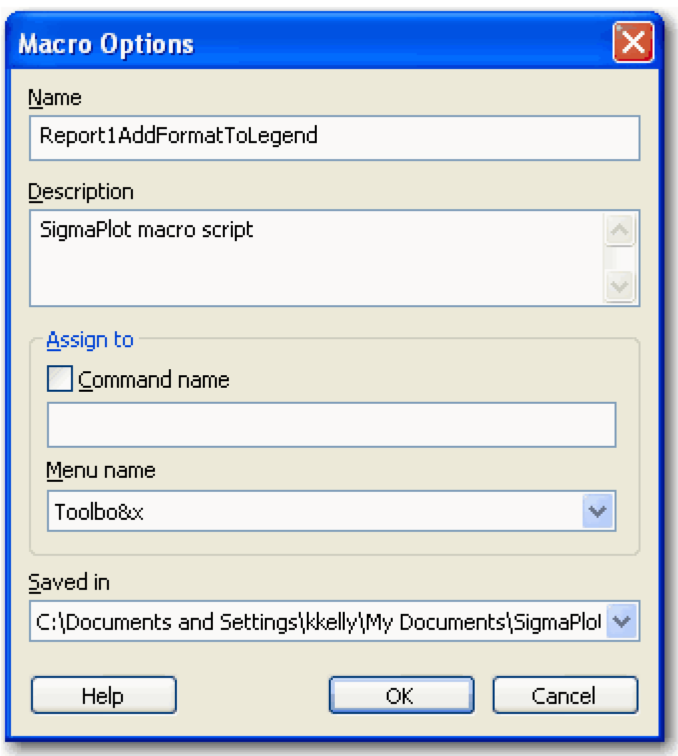
2. Complete the activity you want to include in this macro.

> **Note:**
> The **Macro Recorder** does not record cursor movements.

3. When you are finished recording the macro, on the **Toolbox** tab, in the **Macros** group, click **Stop Recording**.



4. In the **Macro Options** dialog box, type a name for the macro in the **Name** text box.
   Give the macro a descriptive name. You can use a combination of upper- and lowercase letters, numbers, and underscores. For example a macro that formats all of your graph legends to match a certain report might be called "Report1AddFormatToLegend".



5. Enter a more detailed description in the **Description** text box.
6. After you have finished recording the macro, save it globally (for use in all of SigmaPlot) or locally (for use in a particular notebook file). Your macro appears in the **Notebook Manager**.

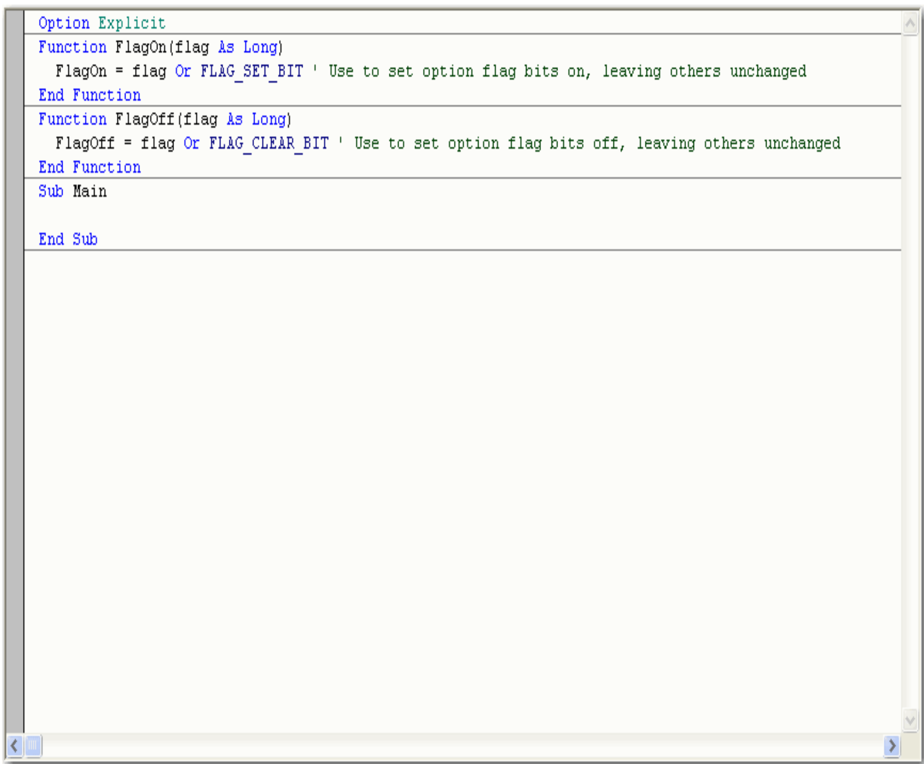
Creating Macros Using the Macro Language

You can record a macro using the **Macro Recorder**, or you can create a macro manually using a VBA®-like macro language in the Macro Window.

To create a macro using the Macro Window:

1. Click the **Main Button** , and then click **New**, and then click **Macro**.
2. The **Macro Window** appears.

Figure 114. A new Macro Window. You can create SigmaPlot macros from scratch using SigmaPlot's VBA-like macro language.



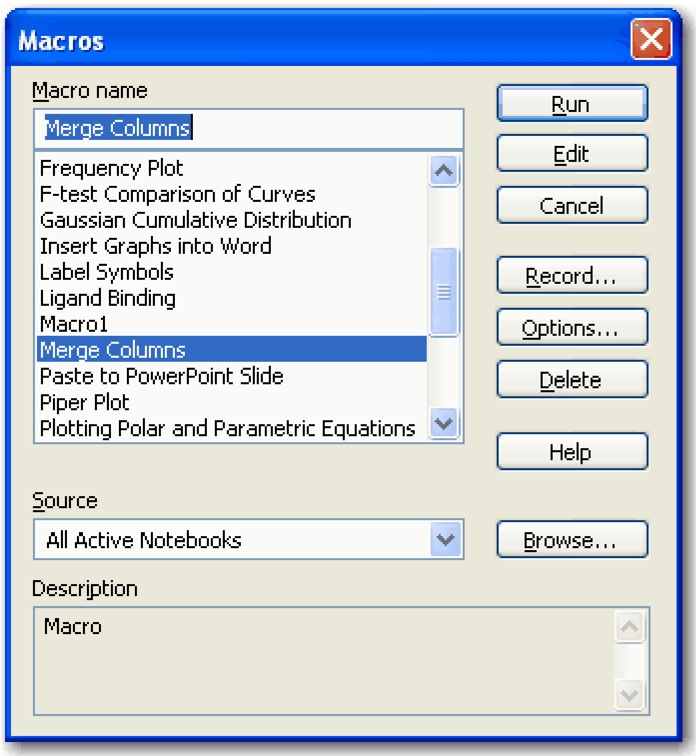
Editing Macros

When you edit the macro, SigmaPlot generates a series of program statements that are equivalent to the actions that you perform. These statements are in a form of SigmaPlot language that has custom extensions specifically for SigmaPlot automation and appear in the **Macro Window**. You can edit these statements to modify the actions of the macro. You can also add comments to describe code.

To edit a macro:

1. On the **Toolbox** tab, in the **Macros** group, click **Macros**.

2. In the **Macros** dialog box, select a macro from the **Macro** list.



3. Click **Edit**. The **Macro Window** appears.

Getting Help for Sax Basic in SigmaPlot

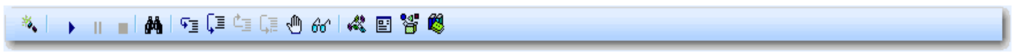
To get help for Sax Basic, in the Macro Window, click on an item you want to learn more about, and press F1.

Tip:
If you are using Windows 7 you are prompted to download a Help conversion program. Do that to see Sax Basic Help items.

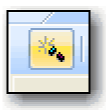
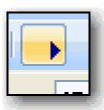
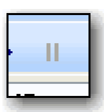
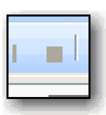
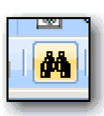
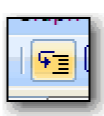
Using the Macro Window Toolbar

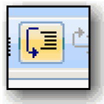
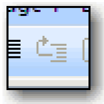
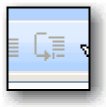
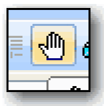
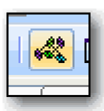
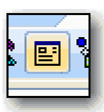
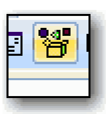
The **Macro Window** toolbar appears at the top of the **Macro Window**. It contains buttons grouped by function.

Figure 115. The Macro Toolbar



The following describes the functions of the toolbar buttons in the **Macro Window**.

Button	Button Name	Function
	New Procedure	Opens the Add Procedure dialog box that lets you name the procedure and paste procedure code into your macro file
	Start	Runs the active macro and opens the Debug Window.
	Pause/Continue	Pauses and restarts a running macro. This button also pauses and restarts recording of SigmaPlot commands while using the Macro Recorder.
	Stop	Terminates recording of SigmaPlot commands in the Macro Recorder. Also, stops a running macro.
	Find	Opens the Find dialog where you can define a search for text strings in the Macro Window.
	Step in	Executes the current line. If the current line is a subroutine or function call, execution will stop on the first line of that subroutine or call.

	Step Over	Executes to the next line. If the current line is a subroutine or a function call, execution of that subroutine or function call will complete.
	Step Out	Steps execution out of the current line the cursor is on.
	Run to Cursor	Steps execution out to the current subroutine or function call.
	Toggle Breakpoint	Toggles the breakpoint on the current line. The breakpoint stops program execution.
	Quick Watch	Shows the value of the expression under the cursor in the Immediate Window.
	Macros	Opens the Macros dialog box.
	User Dialog	Opens the Dialog Box Editor.
	Object Browser	The Object Browser provides lists of the methods and properties that can be called in macros for automating tasks in SigmaPlot.
	Reference	Editing Macros Opens the Reference dialog box which contains a list of all programs that are extensions of the SigmaPlot Basic language.

Color-Coded Display

The color-coding of text in the **Macro Window** indicates what type of code you are viewing. The following describes the default text colors used in the script text:

- **Blue.** Identifies reserved words in Visual Basic (for example, Sub, End Sub, and Dim).
- **Magenta.** Identifies SigmaPlot macro commands and functions.
- **Green.** Identifies comments in your macro code. Separates program documentation from the code as you read through your macros.

Object and Procedure Lists

The **Object** and **Procedure** lists show SigmaPlot objects and procedures for the current macro. These lists are useful when your macros become longer and more complex.

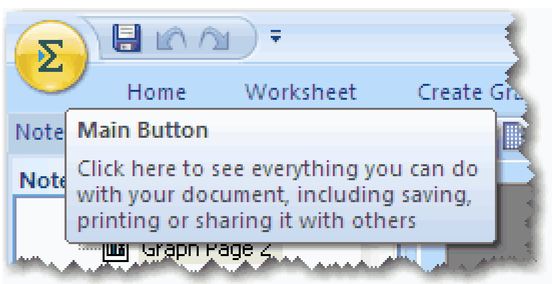
- The object identified as *(General)* groups all of the procedures that are not part of any specific object.
- The **Procedure** list shows all of the procedures for the currently selected object.

Setting Macro Window Options

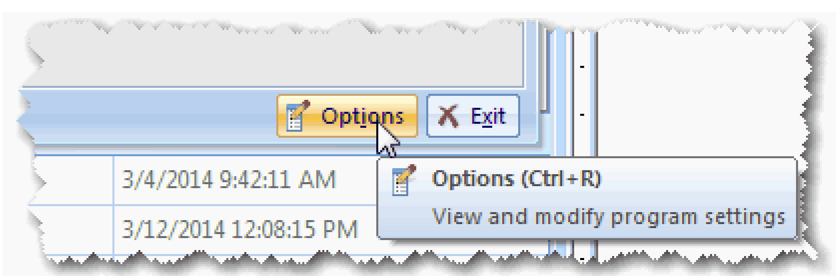
You can set appearance options for the **Macro** window in the **Macros** tab of the **Options** dialog box.

To set the options of the Macro Window:

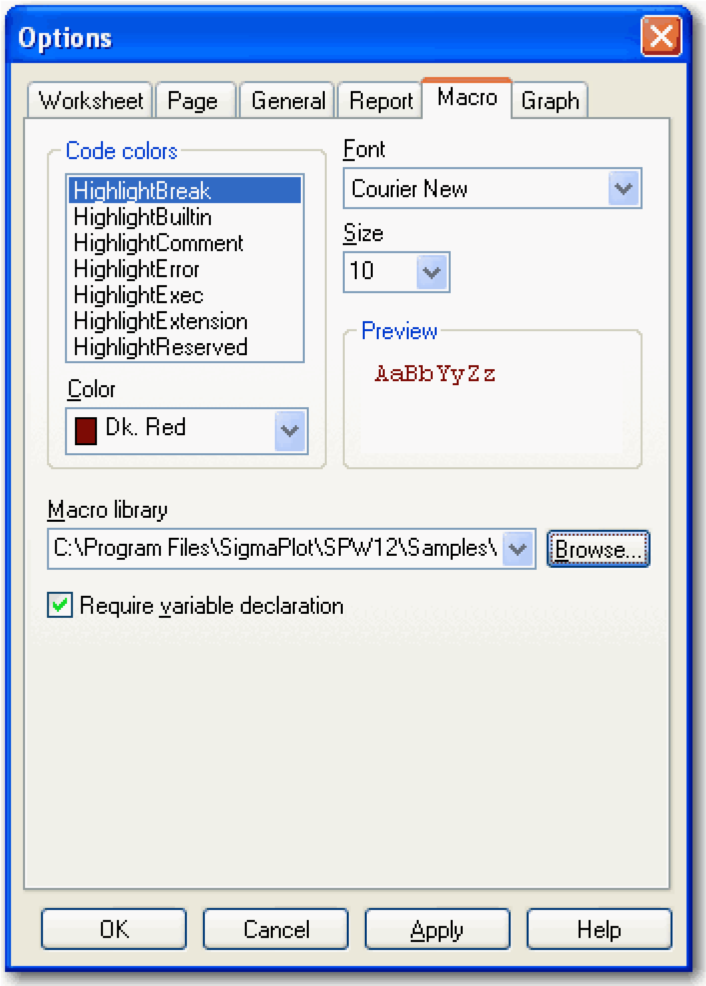
1. With a **Macro** window open, click the **Main Button**.



2. Click **Options**.



3. In the **Options** dialog box, click the **Macro** tab.



4. Set text colors for different types of macro code and **Debug Window** output.
5. Set the location for the macro library.

Parts of the Macro Programming Language

The following topics list the parts of the macro programming language:

- *Statements* are instructions to SigmaPlot to perform an action(s). Statements can consist of keywords, operators, variables, and procedure calls.
- *Keywords* are terms that have special meaning in SigmaPlot. For example, the Sub and End Sub keywords mark the beginning and end of a macro. By default, keywords appears as blue text on color monitors. To find out more about a specific keyword in a macro, select the keyword and press F1. When you do this, a topic in the SigmaPlot on-line reference appears and presents information about the term.

- You can add optional comments to describe a macro command or function, and how it interacts in the script. When the macro is running, comment lines are ignored. Indicate a comment by beginning a line with an apostrophe. Comments always must end the line they're on. The next program line must go on a new line. By default, comment lines appear as green text.

Scrolling and Moving the Insertion Point

When you use the scroll bars the insertion point does not change. To edit the macro code that you are viewing in the macro window, you must move the insertion point manually.

To edit macro code manually:

1. In the **Macro Window**, click where you want to edit.
2. You can also use arrows and key combinations to move the insertion point; when you do this the window scrolls automatically.

Editing Macro Code

You can edit macro code in the same way you edit text in most word-processing and text editing programs. You add select and delete text, type over code, or insert text by moving the insertion point and then typing in new text. As with other programming languages, you can also add comments to code.

To edit macro code:

Open the macro code window and select the text to edit.

- **Adding Comments to Code.** Add comments to code to identify the purpose of the various parts of a macro and to map locations as you edit a complex macro. Insert comments to fully document how to use and how to understand the macro code.
- **Deleting Unnecessary Code.** The **Macro Recorder** creates code corresponding exactly to the actions that you make in SigmaPlot while the recorder was turned on. You may need to edit out unwanted steps.
- **Moving and Copying Code.** You can cut, copy, and paste selected text.
- **Finding and Replacing Code.** When you need to find and change text in a macro that you have written, use the Find commands. For example, if you change the name of a file that is referenced in your macro, you need to change every instance of the file name in your macro. Use **Find** to locate the instances of the filename in the macro and replace using cut and paste edit commands.

Adding Existing Macros to a Macro

If you have another macro that already does what you want, you can just paste it into your new macro. Copy and paste the macro into your new macro, test it in the new code and run it.

Creating Custom Dialog Boxes

Design and customize your own dialog boxes using the **UserDialog Editor**. When you are designing and creating SigmaPlot macros, you can automatically create the necessary dialog box code and dialog monitor function code. Like the other automated coding features in SigmaPlot, the code may require further customizing.

To create a custom dialog box:

1. In the **Macro Window**, place the insertion point where you want to put the code for the dialog box.
2. On the Macro Window toolbar click the **User Dialog** button. The blank grid in the **User Dialog Editor** appears.
3. On the left hand side of the **User Dialog Editor** there is a **Toolbox.** You can select a tool, such as a button or check boxes, from the Toolbox. The cursor changes to a cross when you move it over the grid.
4. **To place a tool on the dialog box,** click a position on the grid. A default tool will be added to the dialog grid.
5. Resize the dialog box by dragging the handles on the sides and the corners.
6. Right-click any of the controls that you have placed on the dialog surface (after selecting the control) and enter a name for the control.
7. Right-click the dialog form (with no control selected) and enter a name for the dialog monitor function in the **DialogFunc** field.
8. To finish, click **OK**. The code for the dialog box with controls will be written to the Macro Window.
   Finally, and in most cases, you must edit the code for dialog box monitor function to define the specific behavior of the elements in your dialog box. For more information, see SigmaPlot Automation Reference *(on page 449)*.

Using the Object Browser

The **Object Browser** displays all SigmaPlot object classes. The methods and properties associated with each SigmaPlot macro object class are listed. A short description of each object appears in the dialog box as you select them from the list.

To view the **Object Browser**, the **Macro Window** must first be in view.

To open the Object Browser:

1. On the **Macro Window** toolbar, click the **Object Browser** button.
2. Use Paste to insert generic code based on your selection into a macro.

> **Tip:**
> Press **F1** at any time for full details on using the **Object Browser**.

Using the Add Procedure Dialog Box

Organizing your code in procedures makes it easier to manage and reuse. SigmaPlot macros, like Visual Basic programs, must have at least one procedure (the main subroutine) and often they have several. The main procedure may contain only a few statements, aside from calling subroutines that do the work. You add procedures using the **Add Procedure** dialog box.

To add a procedure:

1. On the **Macro Window** toolbar, click the **New Procedure** button.
2. In the **Add Procedure** dialog box, define a sub, function, or property using the **Name**, **Type**, and **Scope** boxes.
3. Click **OK** to paste the code for a new procedure. The new procedure appears at the bottom of the macro.

> **Tip:**
> For full details on using the **Add Procedure** dialog box, press **F1** from anywhere in the **Macro Window**.

About User-Defined Functions

A *user-defined function* is a combination of math expressions and Basic code. The function always requires input data values and always returns a value. You supply the function with a value; it performs calculations on the values and returns a new value as the answer. Functions can work with text, dates, and codes, not just numbers. A user-defined function is similar to a macro but there are differences. Some of the differences are listed in the following table.

Recorded Macro	User-Defined Functions
Performs a SigmaPlot action, such as creating a new chart. Macros change the state of the program.	Returns a value; cannot perform actions. Functions return answers based on input values.
Can be recorded.	Must be created in Macro code.
Are enclosed in the Sub and End Sub keywords.	Are enclosed in the keywords Function and End Function.

For more information, press F1 from anywhere in the Macro window to view user-defined function on-line Help.

Creating User-Defined Functions

A user-defined function is like any of the built-in SigmaPlot functions. Because you create the user-defined function, however, you have control over exactly what it does.

A single user-defined function can replace database and spreadsheet data manipulation with a single program that you call from inside SigmaPlot. It is a lot easier to remember a single program than it is to remember several spreadsheet macros. For more information, see SigmaPlot Automation Reference *(on page 449)*.

Using the Debug Window

The **Debug Window** contains a group of features that are helpful when you are trying to locate and resolve errors in your macro code. The debugging tools in SigmaPlot will be familiar if you have used one of the modern visual programming languages or **Microsoft Visual Basic for Applications**.

Essentially, the **Debug Window** gives you incremental control over the execution of your program so that you can sleuth errors in your programs. The **Debug Window** also gives you a precise way to determine the contents of your variables. Again, a series of buttons is used to select the operation mode of the **Debug Window**.

Debug Toolbar Buttons

The debugging features of the **Debug Window** are controlled by buttons on the **Macro Window** toolbar. To review:

- The four **Step** buttons provide methods for controlling the execution of commands. They offer various ways of responding to subroutines and functions.
- The **Breakpoint** button lets you set a point and execute the program until it reaches that point.
- The **Quick View** button displays the value of the expression in the immediate window. The inclusion of these features for controlling program execution are a standard but powerful combination of tools for writing and editing macros.

Debug Window Tabs

The output from the **Debug Window** is organized in four tabs that allow you to type in statements, observe program execution responses, and iteratively modify your code using this feedback.

If you have never used a debugging tool and are new to programming, it would be a good idea to supplement the following description with further study.

Immediate Tab

The Immediate Tab lets you evaluate an expression, assign a specific value to a variable or call a subroutine and evaluate the results. Trace mode prints the code in the tab when the macro is running.

- Type `"?expr"` and press **Enter** to show the value of `"expr"`.
- Type `"var = expr"` and press **Enter** to change the value of `"var"`.
- Type `"set var = expr"` and press **Enter** to change the reference of `"var"` for object vars.
- Type `"subname args"` and press **Enter** to call a subroutine or built-in expression `"subname"` with arguments `"args"`.
- Type `"trace"` and press **Enter** to toggle trace mode. Trace mode prints each statement in the **Immediate Tab** when a macro is running.

Watch Tab

The **Watch Tab** lists variables, functions, and expressions that are calculated during execution of the program.

- Each time program execution pauses, the value of each line in the window is updated.
- The expression to the left of the **"->"** may be edited.
- Pressing **Enter** updates all the values immediately.
- Pressing **Ctrl+Y** deletes the line.

Stack Tab

The output from the **Stack Tab** lists the program lines that called the current statement. This is a macro command audit and is helpful to determine the order of statements in you program.

- The first line is the current statement. The second line is the one that called the first, and so on.
- Clicking a line brings that macro into a sheet and highlights the line in the edit window.

Streamlining Procedures with Macros

Use SigmaPlot macros to help streamline your workflow. For example, you can create macros in **Microsoft Word** or **Excel** that allow you to open SigmaPlot from within either application. You can place macros that you create yourself on the main **Toolbox** tab. You can even run a SigmaPlot macro by specifying its path in your command prompt without ever having to open SigmaPlot. Examples of these macro applications appear in the following topics.

Opening SigmaPlot from Microsoft Word or Excel

You can create a macro in either Microsoft Word or Microsoft Excel that can open SigmaPlot directly from either application.

To create this macro:

1. In either Microsoft Word or Excel, click the **Microsoft Office Button**, and then click **Excel Options**.
2. In the **Popular** category, under **Top options for working with Excel**, select the **Show Developer tab in the Ribbon**check box, and then click **OK**.

3. Click the **Developer** tab, and then in the **Code**group, click **Visual Basic**.
4. Type (or copy and paste):

```
Sub SigmaPlot()

'

SigmaPlot Objects and Collections

'

SigmaPlot Macro

'




'

Dim SPApp as Object

Set SPApp = CreateObject("SigmaPlot.Application.1")

SPApp.Visible = True

SPApp.Application.Notebooks.Add

End Sub 4.
```

5. To run the macro, in Excel, on the **Developer** tab, in the **Code** group, click **Macros**.
6. Click **Run**.
   SigmaPlot appears with an empty worksheet and notebook window.

Running SigmaPlot Macros from the Command Prompt

You can run SigmaPlot macros directly from your command prompt, saving you valuable time. Suppose you need to produce the same graph report of a data set week after week. Rather than going through the trouble of starting up SigmaPlot, opening a file, and then running a macro, you can run the entire macro from a run command on the **Start** menu instead.

In your command prompt type: c:\spw "filename" /runmacro:"macroname".
For example, suppose you want to run a macro that you created called "ErrorBars", and it is stored in a file called **"MyNotebook.jnb"** in your user profile folder. You would type: `C:\program files \sigmaplot\spw15>spw MyNotebook.jnb /runmacro:ErrorBar`.
To run a macro located in SigmaPlot's application folder, you would type: `C:\program files \sigmaplot\15>spw “C:\program files\sigmaplot\spw15\MyNotebook.jnb” / runmacro: ErrorBar`

Tip:
You can also create a batch file or script that runs SigmaPlot from the DOS command prompt as part of the batch file's set of operations.

Creating Macros as Buttons

You can place your macro as a button in either the Pharmacology or Tools group on the Toolbox tab.

To create a new button:

1. On the **Toolbox** tab, in the **Macros** group, click **Macros**.
2. Enter a new macro name in the **Macro name** field.
3. Click **Create**.
4. Under **Assign to**, select **Button**, and then enter the new name in the **Button name** field.
5. Select the group in which you'd like the macro to appear, **Tools** or **Pharmacology**, from the **Group** drop-down list.
6. Click **OK**.

Chapter 11. SigmaPlot Tools

SigmaPlot comes with an extensive library of Macros which we call tools.

The macros, along with their corresponding sample data, can be found in: `ProgramFiles \SigmaPlot\SPW15\SigmaPlot Macro Library.jnb`.

You can double-click the macro in the **Notebook Manager** to run it. If the macro does not have any errors or run into difficulties with your data, it will run to completion.

Tip:
You can also run a macro from the **Macro script window**. This is useful for debugging the macro script.

Running Macros

Click the **Tools** tab. You can run a macro from one of four groups.

- Graphing Tools
- Office Tools
- Pharmacology
- Add Ins

Area Below Curves

This macro integrates under curves using the trapezoidal rule. This can be used for equal or unequally spaced x values. The algorithm is:

$$Area = \sum_i \left[y_i \left(x_{i+1} - x_i \right) + 0.5 \left(y_{i+1} - y_i \right) \left(x_{i-1} - x_i \right) \right]$$

Specify the column number for the results. Click Compute to calculate the area under the curve. The results are in the Results Column.

Restriction:

- This macro only works using a SigmaPlot worksheet.
- This macro only works with plots with both X and Y data.
- A graph window containing a scatter or line plot must be open and in focus when running the macro.

Batch Process Excel Files

Use this macro to import data from multiple Excel Files into individual SigmaPlot worksheets, then plot and curve fit the imported data automatically. The macro plots the first two columns of data for each file as a Simple Scatter Plot, curve fits the data using a Logistic, 4 parameter equation, and generates a statistical report. You are then prompted to save the results in a "BatchFile.jnb" SigmaPlot notebook. This macro is intended as a non-trivial example for you to emulate in you own macros.

The following options are available:

- **Single-step mode.** Displays a dialog box after each step within the macro. For instance, after the Excel data is imported a dialog box appears that states, "The data is imported from the Excel Worksheet..." You must click OK to continue running the macro. By default, this mode is disabled so that the macro runs without stopping at each step.
- **Add File button.** Opens the Select Excel File dialog box. Double-click the Excel file to add it to the Excel files list.
- **Excel Files.** Select the Excel file in the Excel files list to activate this button. Click to delete the file from the Excel files list.
- **Import Range.** Enter the starting and ending ranges to import from the first worksheet in the Excel files. Only the first two columns of imported data are plotted and/or fit.
- **Process.** Plot data as a Simple Scatter Plot or a Simple Bar Chart. Curve fit data using an equation from the drop-down list.
- **Save notebook to.** Shows the path where the BatchFile.jnb notebook is saved.
- **Browse.** Select to save the BatchFile.jnb notebook file to a folder other than the default.

You may edit the macro to change:

- To a different fit library.
- The default location of the source data block.

- Whether the data are plotted or fit.
- The file extension to import different file types.

Restriction:

- Only data from the first Excel worksheet from each file is imported.
- You cannot specify a different Excel worksheet.
- You must select an Excel file.
- You must select a curve in order to plot curve fit.
- You may change the default equation Only simple scatter and bar charts are available.

Bland-Altman Analysis

The Bland-Altman analysis compares two methods to see if they agree. It consists of two, graphs a method comparison graph and the Bland-Altman graph, and some statistics associated with the latter.

Data

Double-click a column or click **>>** in the **Available Columns** list to move it into the appropriate **Method** field under **Selected Columns**.

Plots

Select which type of plot you'd like to appear when you run the macro.

- **Plot Method 1 versus Method 2.** This is a method comparison graph in which an XY scatter plot of the two methods shows the results values. Select **Add Linear Regression Line** to add a linear regression line, and **Add Line of Equality** to add a confidence lines and the line of identity.
- **Plot Bland -Altman Graph.** Select this option to produce a Bland-Altman graph, which is an XY scatter plot in which the difference of the two methods is on the Y axis and the average of the two methods is on the X axis. The mean of the differences is displayed together with the Limits of Agreement for the difference data.

Bland-Altman Difference Statistics

The Bland-Altman graph appears with the following Difference Statistics:

Bias. The mean of the differences.

Std Dev. The standard deviation of the differences.

Limits of Agreement. The mean of the differences (bias) +- 1.96 (or 2) times the standard deviation of the differences.

Confidence Intervals (CI). These are the 95% or 99% CIs for the:

- Bias
- Lower limit of agreement
- Upper limit of agreement

Options

Click **Options** to view and edit the Bland-Altman settings *(on page 405)*.

Bland-Altman Settings

Statistics

Number of SDs (Standard Deviations). This option is used in the Limits of Agreement computation. Select either 1.96 or 2.

No. of decimal places. This option sets the number of decimal places in the difference statistics.

CIs (Confidence Intervals) to be used for B-A plot. Used in difference statistic Confidence Interval computation. Select either 95% or 99%.

Add confidence lines. Select **95%**, **99%** or **None** for the Method Comparison Graph regression confidence lines.

GoTo Column Position. Allows viewing the extents of your data while the Bland-Altman graph Dialog is displayed.

Graph Options. Select to place both graphs on either one or two pages.

Border Plots

This macro draws a histogram or box plot along the top and right axes of a scatter plot. The border plots are located .5 inches from each axis. When using histogram border plots, specify the number of bins displayed.

Restriction:

- A graph window containing a scatter plot must be open and in focus when running the macro. If the current plot is not a scatter plot, the macro can convert the plot to the required form.
- If the plot is an X only or Y only plot, the macro creates one border plot corresponding to the X or Y axis.

By Group Data Split

This macro splits data contained in one column into groups of data sorted into multiple data columns within one SigmaPlot worksheet.

The following options are available:

- **Data Column.** Define the column to begin the data grouping, and to use as column headings.
- **Group Column.** Define the column data to group. This column should not have empty cells.
- **Output Column.** Define the column to begin placing the group results. The default is the First Empty column found in the worksheet. Change the output column location by entering the number of the worksheet column. The Output column must be greater than the last data column.
- **Sort Data.** within the Group Arranges the data within each group into ascending order.

Restriction:

- To run the macro, a worksheet must be open and in focus.
- The worksheet must have at least two columns of data.
- Can accept empty cells. Puts "--" into grouped cell to indicate an empty cell or missing data.
- Group Column should not have empty cells.

- Grouped Data Column Heading Titles correspond to the Group Column contents.
- Output column entry must be numeric and greater than the last data column.

Color Transition Values

This macro creates a column of colors changing smoothly in colors as the data changes from its minimum value to its maximum value and employs this gradient to color the symbols in a scatter plot. Define X and Y columns, as well as the column for displaying the color gradient. The Y column generates the gradient. The scatter plot plots the Y column against the X column with the color column determining the symbol color.

Restriction:
To run the macro, a worksheet must be open and in focus.

Compute 1st Derivative

This macro computes a numerical first derivative of a pair of data columns. It computes the running average of specified adjacent first order derivatives. Both the original data and resulting derivative values can be plotted automatically.

The SigmaPlot transform language 'diff' function is used to compute the first order differences in x and y required for the numerical derivative. The data need not be sorted by x. Replicate x values and the associated y values are row-wise deleted to eliminate zero divides.

To run the macro, choose the first data column and results column. You can also change the length used to determine the running average. Use even values for the length of the running average to place each derivative at the midpoint of the derivatives used in the average. Use odd values to place it at the first point to the left of midpoint.

For even running average length values, there will be len/2 empty cells at the beginning and end of the derivative values.

Finally, you can also automatically generate graphs of the original data and the derivatives.

Dot Density Plot

Data Selection

Select multiple data columns using the **First Column** (left most) and **Last Column** (right most) of data. The data column range need not start in column 1 and may contain empty columns. The number of data columns is limited to 30 except with percentiles lines which are then limited to 5.

Graph Attributes

Symbol Size. Select **Auto** to obtain a reasonable symbol size. Enter a symbol size to obtain exactly that size.

% Overlap. A positive value overlaps the symbols to obtain a grape cluster effect. A negative value creates space between the symbols.

% Width. The percent of total horizontal space taken up by the widest portions of multiple dot densities. Adjustment may be required in some cases to allow space for percentile or box plot display.

Symmetry. The dot density can be symmetric or one-sided.

Orientation.

- **Vertical.** The X axis is the variable, the Y axis is categorical.
- **Horizontal.** The Y axis is the variable, the X axis is categorical.

Graph Dimensions

Select the height and width of the graph. This allows the symbols to touch for different sized graphs.

Axis Scale

Select **Linear** or **Logarithmic**.

Axis Range

- **Automatic.** Select **Automatic** if you'd like the axis minimum, maximum and tick interval to be determined automatically.

If you leave **Automatic** clear, enter **Minimum** and **Maximum** values. These must exceed the minimum and maximum for all data. The data minimum and maximum are displayed when the **Axis Range** is set to **Automatic**.

Other Lines

Line Type.

- **None.**
- **Mean.** Displays a mean line across the dot density.
- **Median.** Displays a median line across the dot density.
- **Percentiles.** Shows "internal" percentile values next to each dot density.
- **Box Plot.** Draws a box plot next to each dot density.
- **MeanStdError.** Shows the mean plus or minus the standard error for each dot density.

Line Length (Percentiles only).

- **Short.** Draws a short indicator line for each percentile.
- **Long.** Draws a line across the dot density for each percentile.

Frequency Plot

Creates frequency plots with mean bars for multiple data columns. The following options are available:

- **Column Selection.** Specify the number of data columns. The analysis includes all columns between the first and the specified column, inclusive. Each column corresponds to a group. In addition, define the column in which to begin placing the macro results.
- **Graph Dimensions.** Set the height and width of the frequency plot in inches.
- **Bins.** The Vertical Interval indicates the range into which data points will be grouped. The Start Value defines the smallest vertical interval value. A value of 0 corresponds to a vertical range from 0 to 100.
- **Mean/Median Lines.** Add a line (of the specified width) corresponding to the mean or median for each group. Symbols Size defines the diameter of the plotting symbols. Gap represents the horizontal distance between symbols as a percentage of the symbol diameter.

Restriction:

- To run the macro, a worksheet must be open and in focus.
- Data must begin in column 1.

F Test Comparison of Curves

You can use the F Test Comparison of Curves macro to compare the fits of two equations to determine if the more complicated equation provides a significantly better fit. For the test to be valid the two equations must be nested; for example, the simpler equation must be a subset of the more complicated one.

The F test is a hypothesis test with the null hypothesis being that the simpler equation is correct. An F ratio is computed which compares the relative difference in the sum of squares of the two fits to the relative increase in the number of degrees of freedom. If this value is significantly greater than 1.0 then the null hypothesis is rejected and the more complicated equation is chosen as the best fit. A P value is used to determine if the F value is significantly greater than 1.0. If $P < 0.05$ then the null hypothesis is rejected and the more complex model is considered the best.

An example is to determine whether the double exponential rise to maximum equation provides a better fit to the data than a single exponential rise to maximum.

Single Exponential Rise to Maximum

$$f = a(1-e^{-bx})$$

Double Exponential Rise to Maximum

Fitting these two equations to the data in the graph below gives the relative increase in the sum of squares

$$f = a(1-e^{-bx}) + c(1-e^{-dx})$$

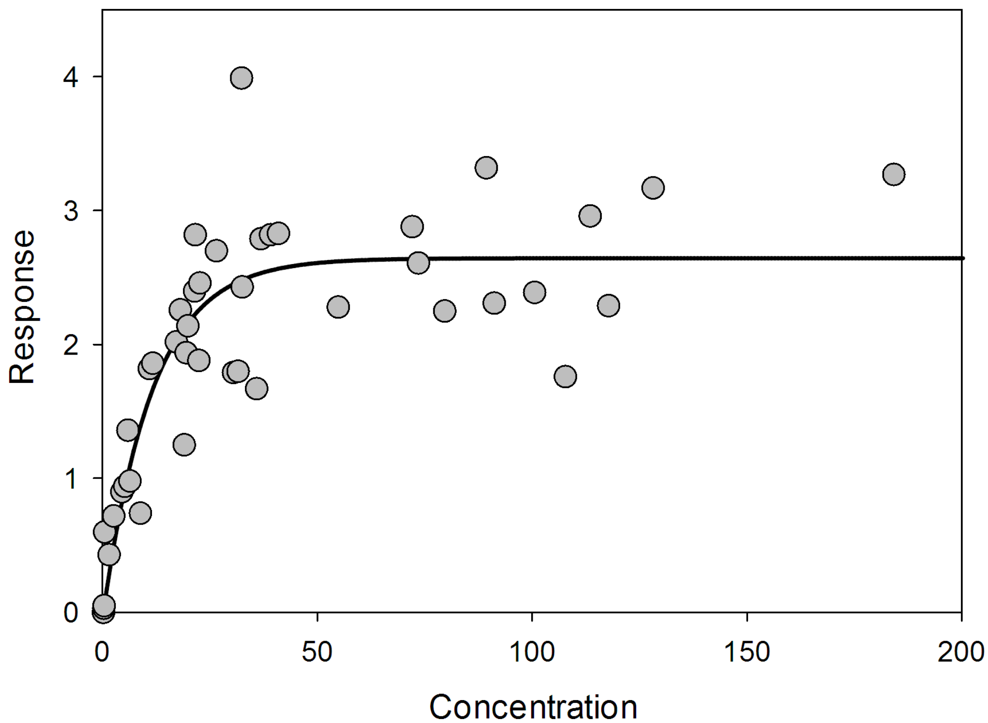
and the relative increase in the degrees of freedom

$$\frac{(DF_{simple} - DF_{complex})}{DF_{complex}} = \frac{(42-40)}{40} = 0.05$$

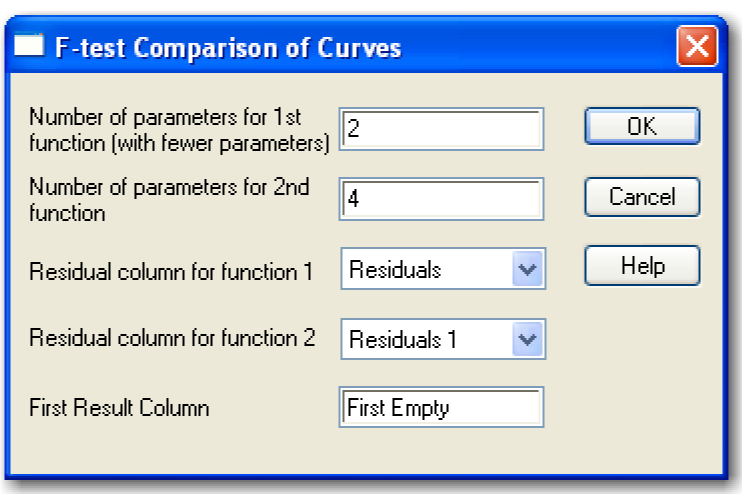
The F ratio is the ratio of these two which is

$$F = \frac{0.02259}{0.05} = 0.4518$$

The P value is computed from the F distribution and is P = 0.65.



If you fit the simpler equation first and then the more complex equation the macro will select for you all the options in **F-test Comparison of Curves dialog box**.



Otherwise you can enter by hand the number of parameters in each equation (simpler equation first) and the columns containing the fit residuals for each equation.

The results are given in the report.

Gaussian Cumulative Distribution

This macro returns the results of a Gaussian Cumulative Distribution function (CDF) for a single column of data, and optionally plots the results with a probability Y axis scale. The error function is approximated with a polynomial approximation.

Heat Maps

Use the clustered heat map macro to create a visualization of numeric data that's assigned to the levels of two categorical variables. You enter this data format as a table in a worksheet. Rows refer to the levels of one variable, and the columns refer to the levels of the other variable.

A heat map for this two-way data appears as a rectangular array of solid colors. The array dimensions and color cell positions match the arrangement of the heat map data in the worksheet.

Heat maps assist in visualizing variations in the density of values in the data table. In other words, use heat maps to identify data clusters.

The following options are available:

Select input columns.

- **Column labels.** Select the worksheet column for the heat map's labels. Leave the display value clear if you are not using column labels.
- **Row labels.** Select the worksheet column for the heat map's row labels. Leave the display value clear if you are not using row labels.
- **First data column.** Select the worksheet column for the first or left-most column of the heat map's data table. This selection is required.
- **Last data column.** Select the worksheet column for the last or right-most column of the heat map's data table. This selection is required.

Select color scale type. Select the type of color scale used in the heat map. You can select one of the following:

- **Discrete color scale.** If you select this option, the first color of the color column maps to the minimum of the data, and the last color of the color column maps to the maximum of the data. The data range is then divided uniformly into groups, and the data within each group maps to the corresponding color in the palette.
- **Continuous color scale.** If you select this option, the first color of the color column or default color palette maps to the minimum of the data, and the last color of the color column or default color palette maps to the maximum of the data. Linear interpolation on the components of the palette colors assigns a color to a particular data value based on the proportion of the data range for locating that data value.

Show Color Bars. Color bars show the data-to-color conversion scale. Select **Show Color Bars** if you want color bars to appear. If they are to appear, decide whether the color bar orientation is vertical (the default) or horizontal.

Display numeric values in heat map. If you select **Display numeric values in heat** map, a symbol plot showing the heat map data table appears on top of the heat map. Numeric values, including missing values, appear over the corresponding heat map cells.

Select colors. Select the color palette.

- **Color column.** Select the palette from the worksheet.

Use default colors shown below. If you select this option, the heat map colors appear using a continuous color scale.

When you click **OK**, the macro code computes the graph data for the heat map, color bar, and data table plot, depending on the selected settings. After the graph data appears in the worksheet, the graphing code in the macro creates a graph page showing the selected plots.

The heat map graph data consists of a rectangular array of all 1s with the exact dimensions of the heat map's data table. The heat map appears as a horizontal stacked bar chart, and this array sets the number and relative size of the bars for the heat map. In addition, there is a column of color data for the heat map where the number of colors in the column equals the number of cells in the data table. This gives a total of N + 1 columns for a heat map's graph data, where N is the number of columns in the input data table.

The data table symbol plot contains three columns of graph data. The first two columns give the coordinate positions of the data values in the heat map, while the last column lists all data values in the data table, column by column, but converted to text as needed for a symbol plot.

The color bar also contains three columns of graph data. A vertical (horizontal) color bar appears as a horizontal (vertical) bar chart. If you use a continuous color scale, the first column consists of 101 numeric values that uniformly span the range of the heat map data. The second column consists of 101 values, equal to 1, for setting the size of the bars. The last column applies the color scale to the first column of data values to generate 101 colors for the color bar. Using a discrete color scale, the same types of columns appear, but each column has the same number of rows as the color column selected in the dialog box.

The heat map appears below for the worksheet data and setting shown above in the dialog box. After the graph appears, use Graph Properties for any desired edits *(on page 30)*.

Entering Heat Map Data

Arrange heat map data using many columns. One column is for column labels, and another is for row labels. These labels appear on the axes for the heat map. However, you can also create a heat map without any labels.

1	2	3	4	5	6
Placebo	a	32.0000	33.0000	21.0000	
Hormone A	b	33.0000	46.0000	31.0000	
Hormone B	c	45.0000	51.0000	32.0000	
	d	61.0000	60.0000	44.0000	
	e	19.0000	23.0000	17.0000	

Enter the heat map data in adjoining columns. The number of rows of data can vary among the columns. When you create the heat map, the number of rows in the heat map equals the maximum number of rows in the selected data. You can also enter non-numeric data in the data table, which SigmaPlot treats as missing values. The color assigned to a missing value is transparent.

You need one more column for a color palette for the heat map colors. You create the palette using the Insert Graphic Cells dialog box, the transform language, or manually typing in a color code.

The colors assigned to the worksheet data depend on whether a discrete or continuous color scale is selected. The scales are based on the palette in the color column. For discrete color scales, the color column often uses an existing color scheme of 7 to 10 colors. The color column often contains only two or three colors for continuous color scales but can contain more.

Viewing Heat Map Examples

To find heat map data examples:

1. Select the **Help** tab.
2. Click **Macro Data** in the **Sample Files** group.
   The Macro Data Sets notebook opens in the Notebook Manager. Heat map examples appear in three sections.

Insert Graphs into Microsoft Word

Use this macro to insert a SigmaPlot graph into an open Microsoft Word document.

1. In your Word Document, place your cursor at the position where you want to insert the graph.
2. The macro lists all graph pages in your currently active notebook. Select the page containing the graph(s) you want to insert.
3. Adjust the size and positioning of the figure as desired, then click Insert. All graphs on the selected page are placed into the specified frame. The next version of this macro will also allow selection of a specific graph on a page.
4. To insert additional graphs from this notebook, move to where you want to place the graph in Word, then switch back to SigmaPlot, click the desired page, and click Insert.

   Restriction:
   You must have both a Word Document and a SigmaPlot notebook open in order to use this macro.

Label Symbols

This macro labels a scatter or simple bar plot with text from a specified column. Select an offset percentage and one of eight locations for the labels. The offset percentage is a percent of each axis range - 3 to 5 percent is a good starting value. If you have more than one plot in your graph then select the plot you want to label by clicking on a symbol or bar of the particular plot.

Rerun the macro to obtain the best position for the labels and then use Graph, Delete Plot to remove the unwanted label plots.

You can label the plot with numbers by placing the numbers in a column and using Format, Cells to change the numbers to text. Then format each text-number for a pleasing appearance by removing places to the right of the decimal point, and so on.

If the label column contains fewer entries than the plot contains symbols or bars, labeling continues by returning to the first case of the label column. For example, in a scatterplot containing six points, if the label column contains three entries (A,B,C), the points are labeled (A,B,C,A,B,C).

Restriction:

- A graph window must be open and in focus when running the macro.
- The macro is restricted to scatter and simple bar charts and is not applicable to stacked or grouped bar charts.

Merge Columns

This macro merges two separate worksheet columns into one single text column. This is useful if you have two text fields that need to be combined into one, or if you have imported data that contains dates in one column and time in another.

To run the macro, simply select the first and second columns to merge, then click OK.

Restriction:
At least two columns of data must present on your worksheet. The results are automatically placed into the first empty column after the last data column.

Paste to PowerPoint Slide

This macro creates PowerPoint slides from selected SigmaPlot graphs.

1. To create a PowerPoint slide:

    a. Open PowerPoint and create a new presentation or open an existing one.

    b. Select the slide where you want to place the SigmaPlot graph.

    c. Select a slide background if so desired.

d. In SigmaPlot select the graph or multiple graphs that you want to paste into PowerPoint.

e. On the **Tools** tab, in the **Office Tools** group, click **Paste to PowerPoint Slide**.

f. Select **Bold text** and **Change the text color to** to contrast with the PowerPoint background color. Note that **Transparent Graph Background** is selected. This allows the PowerPoint background color to show through the graph.

g. Thicken the lines and change their color if so desired.

h. Click **OK**.
PowerPoint opens, and the graph object appears centered in a new PowerPoint slide.

2. To edit the graph object in PowerPoint:
   a. Open the PowerPoint presentation with the inserted SigmaPlot graph.
   b. Use **Graph Properties** to edit.

Piper Plots

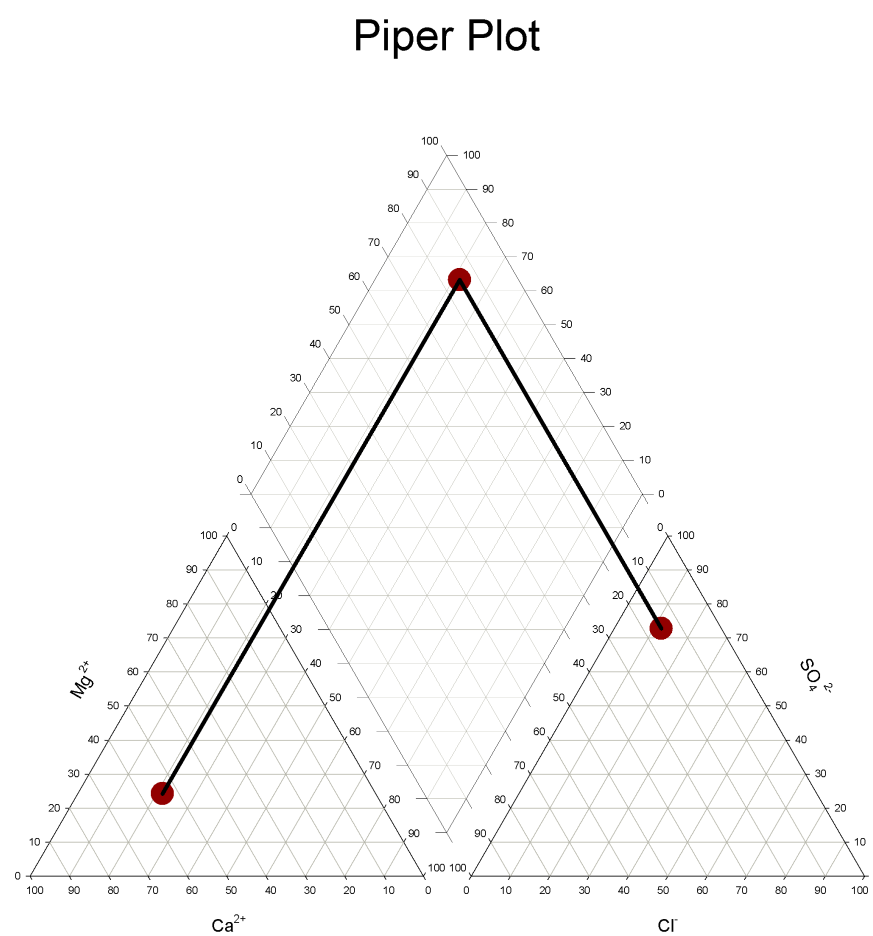
To create a Piper plot:

1. Make sure the values of your four cations and three anions are entered into seven columns.
2. Pick the units the data use. If the units used do not match any of the options (percentages, mg/l, or mmol/l) then you will need to transform your data to one of these units.
3. Assign the column for each cation/anion as desired by selecting a worksheet column from the Worksheet columns list, the cation/anion from the Assign to list, and clicking the Assign button. You column assignments are listed under Assigned columns.
4. When finished, click **OK**.

About the Piper Diagram

The PIPER diagram (Piper, 1944) is a plot commonly used by hydrogeologists and hydrologists to display water chemistry data. It has the advantage that many different water samples can be plotted on one graph. The major dissolved ionic species in most natural waters are Ca2+, Mg2+, Na+, K+, Cl-, HCO3- and SO42-. The PIPER diagram displays the relative proportions of the major cations (positively charged ions) and anions (negatively charged ions) on two adjacent triangular plots (Figure 1). For plotting purposes, Na and K are grouped together. Each apex of the triangle represents 100% of that component and mixtures of components plot either along the axes (for 2 components) or within the triangle (for 3 components).

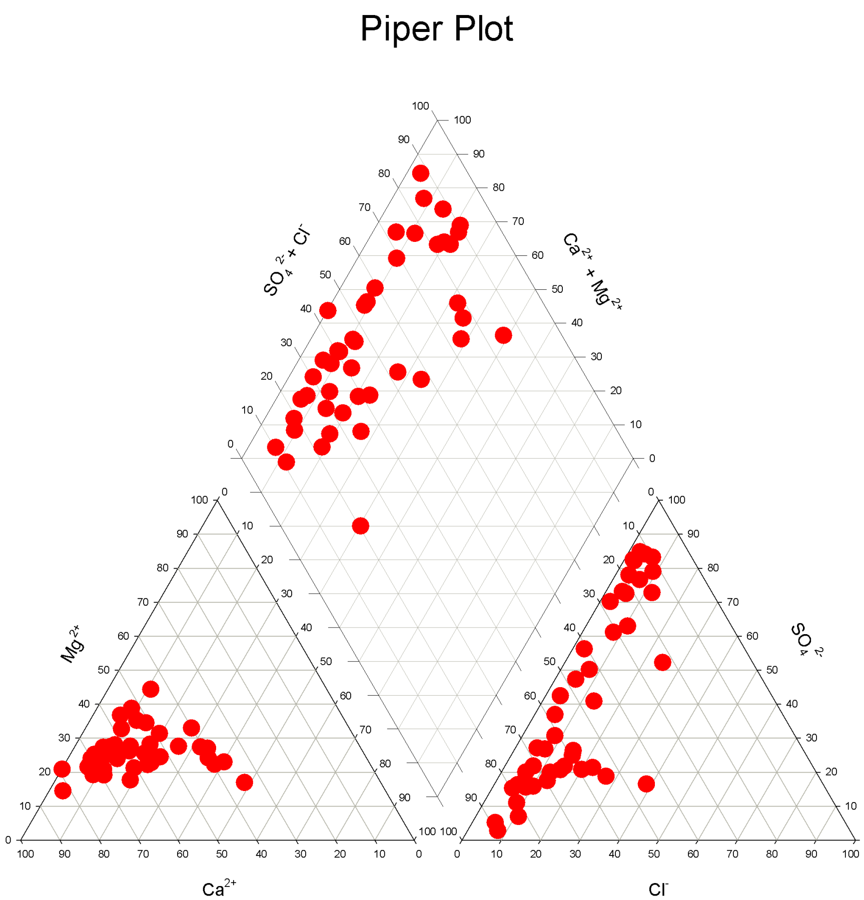
Figure 116. PIPER Diagram Showing how the Relative Proportions of Cations and Anions are Plotted



The PIPER diagram above shows how the relative proportions of cations and anions are plotted. The diamond shaped graph is used to represent the composition of water with respect to both cations and anions. This graph has the advantage that mixing between two waters plots as a straight line. The cation and anion points for each sample are projected onto the diamond shaped field along a line parallel to the outer axes of each triangular plot as shown in the figure below and the intersection of these points is plotted. The PIPER diagram can be used to classify "hydrochemical facies" or "water-types" based on the dominant ions.

The proportions of different elements provide information on the chemical history of groundwaters and indicate the dominant chemical reactions that occur between groundwater and the rocks through which it passes. Some data from a sandstone aquifer in Yorkshire are shown in the figure below where it can be seen that the groundwaters generally vary from a Ca-HCO3 type to a Ca SO4 type due to the dissolution of the minerals calcite (CaCO3) and gypsum (CaSO4). Some samples also trend towards the Na and Cl apex of the plots due to mixing with an old seawater component (dominated by Na and Cl). Piper, A.M. 1944 A graphic procedure in the geochemical interpretation of water analysis. Transactions, American Geophysical Union, 25, 914-923.

Figure 117. The Distribution of Water Types from a Sandstone Aquifer in the Vale of York Displayed on a PIPER Diagram



The PIPER diagram above displays the distribution of water types from a sandstone aquifer in the Vale of York.

Plotting Polar and Parametric Equations

This macro creates curves in either Cartesian or polar coordinate systems.

1. Select **Rectangular** or **Polar** as the **Coordinate System**.
2. Select **Single Equation** or **Parametric** as the **Curve Description**.

   A curve description can be:

   - A single equation relating the two coordinate variables (such as y=x^2 or r = cos(2*theta)).
   - A pair of equations that define the coordinate values of points on the curve in terms of a third parameter variable (such as x = cos(t), y=sin(t), or r= t*sin(2*t), theta = t^2).
3. Set the range of the **Independent variable** and the number of sampled intervals within that range.
4. Set the **Angular Units** to either **Radians** or **Degrees**.
5. Click **Close** to close the dialog box.

Power Spectral Density

Computes the power spectral density (psd) for a data column. Specify two columns: the data column and the results column. In addition, define the sampling frequency and whether the macro should employ a Hanning window.

The macro creates two plots:

- Amplitude versus Time
- PSD versus Frequency

> **Restriction:**
> To run the macro, a worksheet must be open and in focus.

Quick Re-Plot

This macro quickly reassigns the columns that are plotted for the current curve in the current two- or three-dimensional plot. Click **Next Curve** to change the plotted columns for several curves simultaneously.

> **Restriction:**
> To run the macro, a graph must be open and in focus.

Rank and Percentile

Computes ranks and cumulative percentages for a specified data column. Specify the following:

- **Data Column.** The data to be ranked. SigmaPlot also computes cumulative percentages for this column.
- **Percentile Column**. A column containing percentiles. SigmaPlot returns the raw value corresponding to these percentiles.
- **Results Column.** The worksheet column at which the results should begin.
- **Percentile Type.** One of two methods of computing percentiles must be selected.
- **Numeric.** No adjustment made to the values.
- **Graphing.** The Cleveland definition of percentiles described in The Elements of Graphing Data by William S. Cleveland (1985), in which .5 is subtracted from the positions before computing percentages.

The macro returns the sorted data, an index of the original positions, the ranks, and the cumulative percentages. Specifying a column of percentiles yields the values corresponding to those percentiles.

Restriction:
To run the macro, a worksheet must be open and in focus.

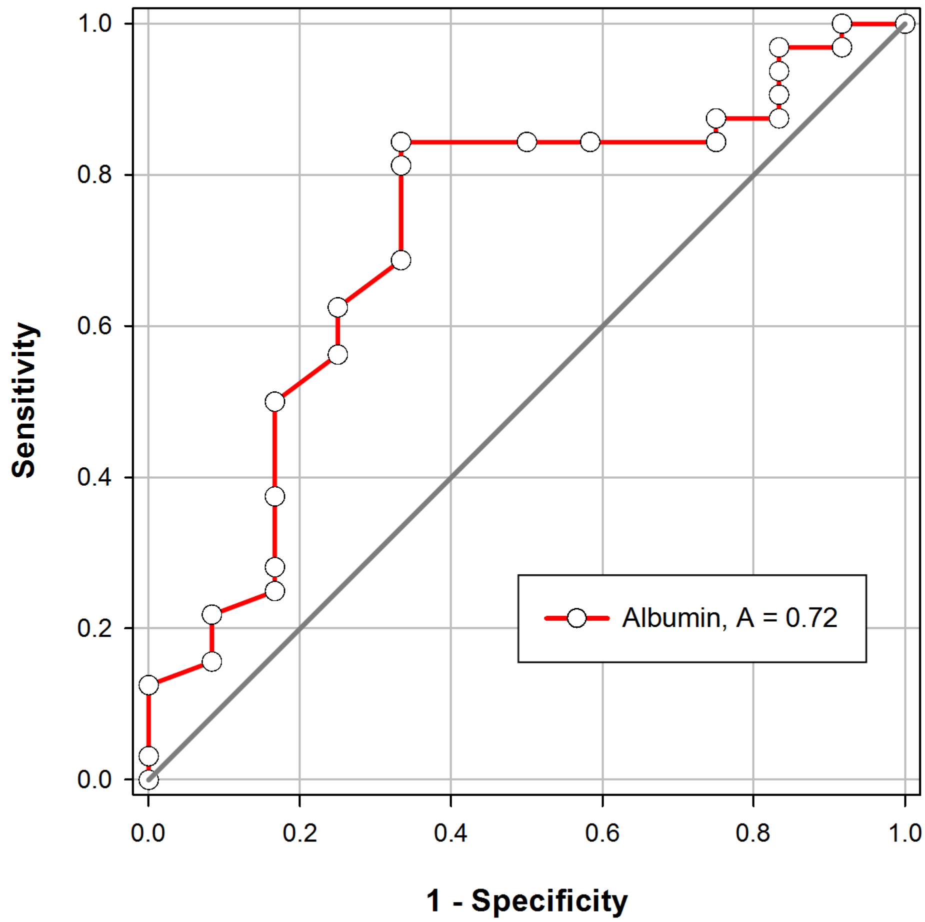
ROC Curve Analysis

Receiver operating characteristic (ROC) curves are used in medicine to determine a cutoff value for a clinical test (its origin, and the origin of its name, is from radar signal detection). For example, the cutoff value of 4.0 ng/ml was determined for the prostate specific antigen (PSA) test for prostate cancer. A test value below 4.0 is considered to be normal and above 4.0 to be abnormal. Clearly there will be patients with PSA values below 4.0 that are abnormal (false negative) and those above 4.0 that are normal (false positive). The goal of an ROC curve analysis is to determine the cutoff value.

Assume that there are two groups of men. By using a "gold standard" technique, one group is known to be normal (negative), not to have prostate cancer, and the other is known to have prostate cancer (positive). A blood measurement of prostate-specific antigen is made in all men and used to test for the disease. The test will find some, but not all, abnormals to have the disease. The ratio of the abnormals found by the test to the total number of abnormals known to have the disease is the true positive rate (also known as sensitivity). The test will find some, but not all, normals to not have the disease. The ratio of the normals found by the test to the total number of normals (known from the "gold standard" technique) is the true negative rate (also known as specificity). The hope is that the ROC curve analysis of the PSA test will find a cutoff value that will, in some way, minimize the number of false positives and false negatives. Minimizing the false positives and false negatives is the same as maximizing the sensitivity and specificity.

For the PSA test abnormal values are large (> 4) and normal values are small (<4). This is not always the case, however, so the present macro allows for both conditions of abnormal being larger and abnormal being smaller.

The ROC curve is a graph of sensitivity (y-axis) versus 1 - specificity (x-axis). An example is shown below. Maximizing sensitivity corresponds to some large *y* value on the ROC curve. Maximizing specificity corresponds to a small x value on the ROC curve. Thus a good first choice for a test cutoff value is that value which corresponds to a point on the ROC curve nearest to the upper left corner of the ROC graph. This is not always true however. For example, in some screening applications it is important not to miss detecting an abnormal therefore it is more important to maximize sensitivity (minimize false negatives) than to maximize specificity. In this case the optimal cutoff point on the ROC curve will move from the vicinity of the upper left corner over toward the upper right corner. In prostate cancer screening, however, because benign enlargement of the prostate can lead to abnormal (high) PSA values, false positives are common and undesirable (expensive biopsy, emotional impact). In this case maximizing specificity is important (moving toward the lower left corner of the ROC curve).



An important measure of the accuracy of the clinical test is the area under the ROC curve. If this area is equal to 1.0 then the ROC curve consists of two straight lines, one vertical from 0,0 to 0,1 and the next horizontal from 0,1 to 1,1. This test is 100% accurate because both the sensitivity and specificity are 1.0 so there are no false positives and no false negatives. On the other hand a test that cannot discriminate between normal and abnormal corresponds to an ROC curve that is the diagonal line from 0,0 to 1,1. The ROC area for this line is 0.5. ROC curve areas are typically between 0.5 and 1.0 like shown in above.

Two or more tests can be compared by statistically comparing the ROC areas for each test. The tests may be correlated because they occurred from multiple measurements on the same individual. Or they may not be correlated because they resulted from measurements on different individuals. The ROC Curves Analysis Module refers to this as "Paired" and "Unpaired", respectively, and can analyze either situation.

The test measurements may contain missing values and two methods are provided to handle missing values when comparing ROC areas- pair-wise deletion and case-wise deletion. This is described in detail later.

Given a value for the probability that the patient has the disease (pre-test probability) the probability that the patient has the disease, given the value of the test measurement, can be computed. Also, given a value for the false-positive/false-negative cost ratio (for the screening example above, the false-negative cost would be greater than the false-positive cost), an optimal test value cutoff can be computed. The present macro allows entry of the pre-test probability and the false-positive/false-negative cost ratio.

Entering Data for the ROC Curves Macro

The ROC Curves macro accepts both indexed and grouped data formats. In most cases SigmaPlot identifies the data format from the information in the data worksheet.

Indexed Data

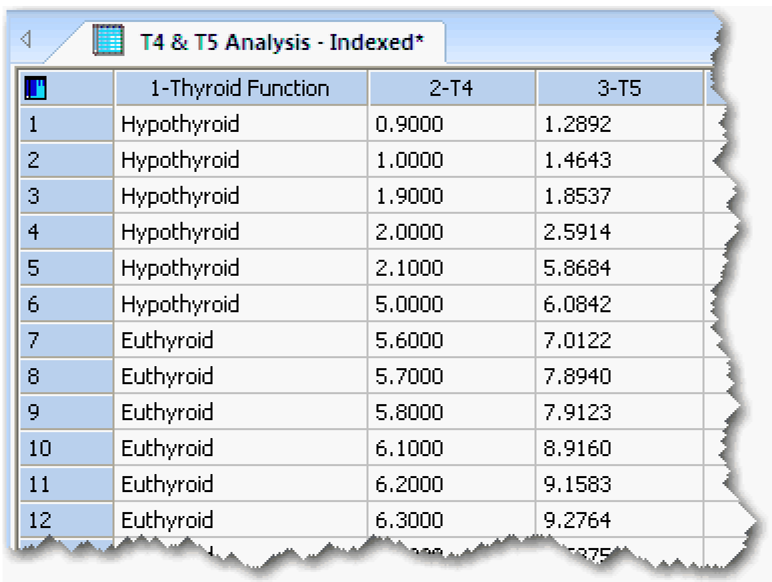
Indexed data is the format found in statistics programs such as Systat and SigmaStat (the statistics in SigmaPlot). "Indexed" is the terminology used in SigmaStat. It has one column that indexes another column (or other columns). It is also the format of the output of logistic regression where ROC curves are used to determine the ability of different logistic models to discriminate negative from positive test results (normals from abnormals). Each data set consists of a pair of columns - a classification variable and a test variable. The classification variable has a binary state that is either negative (normal) or positive (abnormal). Many programs use a value of 1 for positive and 0 for negative. The classification variable is required to be located in column 1 of the worksheet. The test variable is a continuous numeric variable and contains the test results. A single test variable will be located in column 2. Multiple test variables will be located in multiple columns starting in column 2. There is no built-in limit for the number of test variables. There is only one classification variable for multiple test variables and it is located in column 1. The test variable columns must be left justified and contiguous. Therefore, no empty columns to the left of or within the data are allowed.

The following example shows a few rows of data for two data sets. The first column is the classification variable. It contains a column title "Thyroid Function", which is the classification variable name. It also contains the two classification states "Hypothyroid" and "Euthyroid" (normal thyroid function). Hypothyroid and Euthyroid are the abnormal and normal classification states, respectively. T4 and T5 are the names of different blood tests that will be used in the ROC analysis to discriminate between normal and abnormal and then compared to determine which is the better test.

The classification variable must be in column 1 and the two test variables in the two columns adjacent to it.

The classification variable name will be obtained from the column 1 column title if it exists. The test names will be obtained from the column titles of the test variable columns if they exist. The classification state names will be obtained from the entries in the cells of column 1. If no column titles have been entered for the test variables then default names for the tests, "Test 1", "Test 2", etc., will be used and displayed in the graphs and reports. The test variable names should be unique but the program will subscript any identical names that are not.

Figure 118. Indexed Data Format for Two Tests. The test names are T4 and T5, the classification states are Euthyroid and Hypothyroid and the Classification variable name is Thyroid Function. The index column is always column 1 and data columns must be left adjusted.


T4 & T5 Analysis - Indexed*

	1-Thyroid Function	2-T4	3-T5
1	Hypothyroid	0.9000	1.2892
2	Hypothyroid	1.0000	1.4643
3	Hypothyroid	1.9000	1.8537
4	Hypothyroid	2.0000	2.5914
5	Hypothyroid	2.1000	5.8684
6	Hypothyroid	5.0000	6.0842
7	Euthyroid	5.6000	7.0122
8	Euthyroid	5.7000	7.8940
9	Euthyroid	5.8000	7.9123
10	Euthyroid	6.1000	8.9160
11	Euthyroid	6.2000	9.1583
12	Euthyroid	6.3000	9.2764

There must be two or more non-missing data points for each test for each classification state. Missing values are handled automatically by the analysis. For data columns, missing values are everything but numeric values (blank cells, the SigmaPlot double-dash missing value symbol, "+inf", "-inf", "NaN", etc.). Missing values are ignored for all computations except the Paired area comparison (see the Missing Value Method section) where they are handled using one of two possible algorithms.

Grouped Data

The grouped data format consists of pairs of data columns - one pair for each test. One column in a data pair consists of the negative (normal) data values and the other column for positive (abnormal) values. So, for example, if two tests are to be compared, the worksheet will contain four columns of data - the first two columns for the first test and the third and fourth column for the second test.

A specific column title format is used to identify the test associated with the data column pair and the classification states within each pair. The user is encouraged to use this format since it clearly identifies the data in the data worksheet and will annotate all the graphs and reports generated. It is not necessary to use column titles as the program will identify column pairs starting in column 1 with the generated test names "Test 1", "Test 2", etc., and will arbitrarily assign "1" and "0" classification state names to the first and second columns, respectively, but this is clearly not the best way to organize the data. Since the test names and classification states are numerical it is also more difficult to interpret the results.

Column Title Convention for Grouped Data

This column title convention is a simple way to identify worksheet data for the Grouped data format. The following example shows a few rows for two data sets. The first two columns contain the data for the T4 test. The first column "T4 - Euthyroid" is the column with the normal data for test T4. The column title consists of the test name followed by a minus sign followed by the classification state. Spaces on either side of the minus sign are ignored. The second column "T4 - Hypothyroid" is the column with the abnormal data for test T4. The third and fourth column titles are the same as the first two except the second test name T5 is used.

Figure 119. Grouped Data Format for Two Tests . This is the same data as in the figure above. There are two tests T4 and T5. Each test consists of a pair of data columns. In this case T4 is in columns 1 and 2 and T5 in columns 3 and 4. The "Test-State" column title format is used to identify the two tests and the normal (Euthyroid) and abnormal (Hypothyroid) states.

T4 & T5 Analysis - Indexed* | T4 & T5 Analysis*

	1-T4 - Euthyroid	2-T4 - Hypothyroid	3-T5 - Euthyroid	4-T5 - Hypothyroid
1	5.0000	0.9000	5.4738	1.1420
2	5.6000	1.0000	6.8265	1.2730
3	5.7000	1.9000	7.1945	1.3160
4	5.8000	2.0000	7.3726	2.1110
5	5.9000	2.1000	7.4853	2.2120
6	6.1000	2.3000	7.7890	3.5620
7	6.2000	2.4000	8.4820	4.1890
8	6.3000	3.8000	8.9990	4.2730
9	6.6000	3.8000	9.1460	4.6780
10	6.6500	4.0000	9.3180	5.0850
	6.7000		9.5550	[illegible]

The test names in both columns of a column pair must be the same. Also there must be exactly two classification states in the column titles.

Like Indexed format, missing values in the worksheet cells are ignored except for special handling when comparing ROC areas (see the Missing Value Method section).

Setting ROC Curve Analysis Options

You immediately set ROC Curve Analysis options upon running the macro.

Data Selection

For more information about entering macro data, see Entering Data for the ROC Curves Macro *(on page 424)*.

Data Format. In most cases the ROC Curve Analysis macro identifies the data format from the information in the data worksheet. You may select from the two formats: Indexed and Grouped.

Data Type. If two or more data sets are selected then the Data Type option for correlated tests is available. The data is correlated when two or more tests are obtained on the same individual.

You may select either Paired, for correlated tests, or Unpaired. If Paired is selected the ROC areas and area comparisons are determined using the DeLong, Delong and Clarke-Pearson method. If Unpaired is selected the areas are computed using the Hanley and McNeil method and the areas are compared using a Z test.

Missing Value Method. If missing values exist then two options are available for the pairwise comparison of ROC areas - Pairwise Deletion and Casewise Deletion. This option is not available if no missing values exist.

Pairwise deletion only deletes rows containing missing values for the particular pair being analyzed – not for an entire row of data. Fewer data values are deleted using this method. There are situations when pairwise deletion will fail but this is the option to use when it is possible. Casewise deletion deletes all cells in any row of data containing a missing value. Much more data may be deleted using this option. To better understand the difference, consider a simple example of two data columns of equal length one of which has no missing values and the other has one missing value. When ROC areas are being compared, certain computations on these two columns will be done pairwise - the first column with itself, the first column with the second column and the second column with itself. When the column without a missing value is being compared with itself no row deletions occur for pairwise deletion. For casewise deletion, however, the row that contains the missing value will be deleted from both data sets. So, for casewise deletion, the computation involving the column without a missing value with itself will be done with one row deleted (the row corresponding to the missing value in the other data set). The macro determines when pairwise deletion is not valid and informs the user when this is the case.

Positive State Options

The two classification states are referred to as "Negative" (normal) or "Positive" (abnormal). You must specify which state is Positive and whether the test measurement values for the positive state are High, meaning higher than those of the negative state, or Low, meaning lower than those of the negative state.

Accepted normal values for the PSA (prostate specific antigen) test are less than 4 ng/ml and abnormal values are higher than this; thus if the two classification states names are "positive" and "negative" then the **Positive State** is "positive" and the **Positive Direction** is "High". In this case you would select **Positive** and **High**.

On the other hand, for the T4 (thyroxine) test for hypothyroidism the T4 values are lower in the abnormal state than for the normal state. In this case the abnormal Positive State is "Hypothyroid" and the Positive Direction is "Low". So you would select **Hypothyroid** and **Low**.

What happens if you select the incorrect option? Sensitivity (specificity) is defined in terms of the positive (negative) state. So if the positive state is incorrectly selected then sensitivity and specificity will be incorrectly defined (switched) and the ROC curve will have the X and Y axes switched. This will result in an ROC curve that appears below the diagonal unity line. It will have an area less than 0.5. The ROC Curve Analysis macro will detect this and give you the following options.

It is possible that there is something wrong with the data so you can abort the analysis and correct the problem. More likely you have selected the incorrect positive state or direction so you can Retry the analysis with correct selections. In rare occasions for multiple tests some tests will have areas greater than 0.5 and one or more will have areas less than 0.5. In this case you can Ignore this warning and continue with the analysis.

Available Data Sets - Selected Data Sets

Select one or more of the available data sets by clicking on them in the Available Data Sets window and then clicking on the Add button. If desired, you may then select a test name in the Selected Data Sets window and click Remove to deselect the test.

Reports

Confidence level. Confidence levels are computed for statistics in both the Sensitivity and Specificity and Area Comparison reports. You can generate 90, 95 and 99% confidence intervals.

Create sensitivity and specificity. Cutoff values are created between each test data value in the (sorted) data set. If there are a large number of data points and several tests then there will be a large number of cutoff values and the Sensitivity and Specificity Report can be very long. If you clear this option then all report options in the dialog box below this are not required and are disabled.

Results in. You may display sensitivities, specificities and probabilities in either fraction or percent format. Selecting Percents also requires the pre-test probability to be entered as a percent.

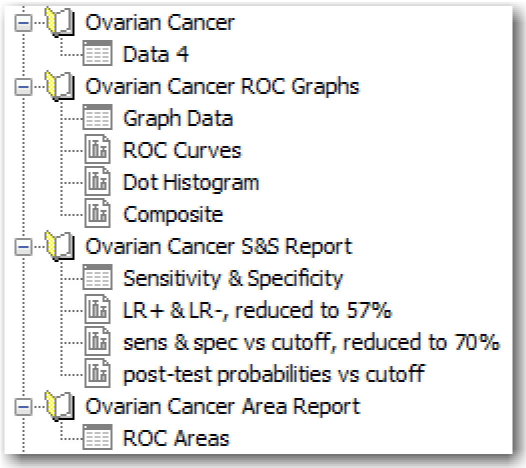
Create post-test results. Selecting this option allows entry of the pre-test probability. It also enables the possible entry of the false-positive/false-negative cost ratio. Given a pre-test probability the program will create post-test probabilities, both the positive predictive value (PV + = probability of disease given a positive test result) and the negative predictive value (PV - = probability of no disease given a negative test result), for each cutoff value. If the cost ratio option is selected then the optimal cutoff value will be computed. All of these results are displayed for each test in the Sensitivity and Specificity report.

ROC Graph

All of the graph options in the dialog box apply to the ROC graph. They allow you to add a diagonal line to the graph, add grid lines, add symbols for sensitivity and specificity at each cutoff point and change the ROC plot lines from solid to different line styles.

Analyzing ROC Analysis Results

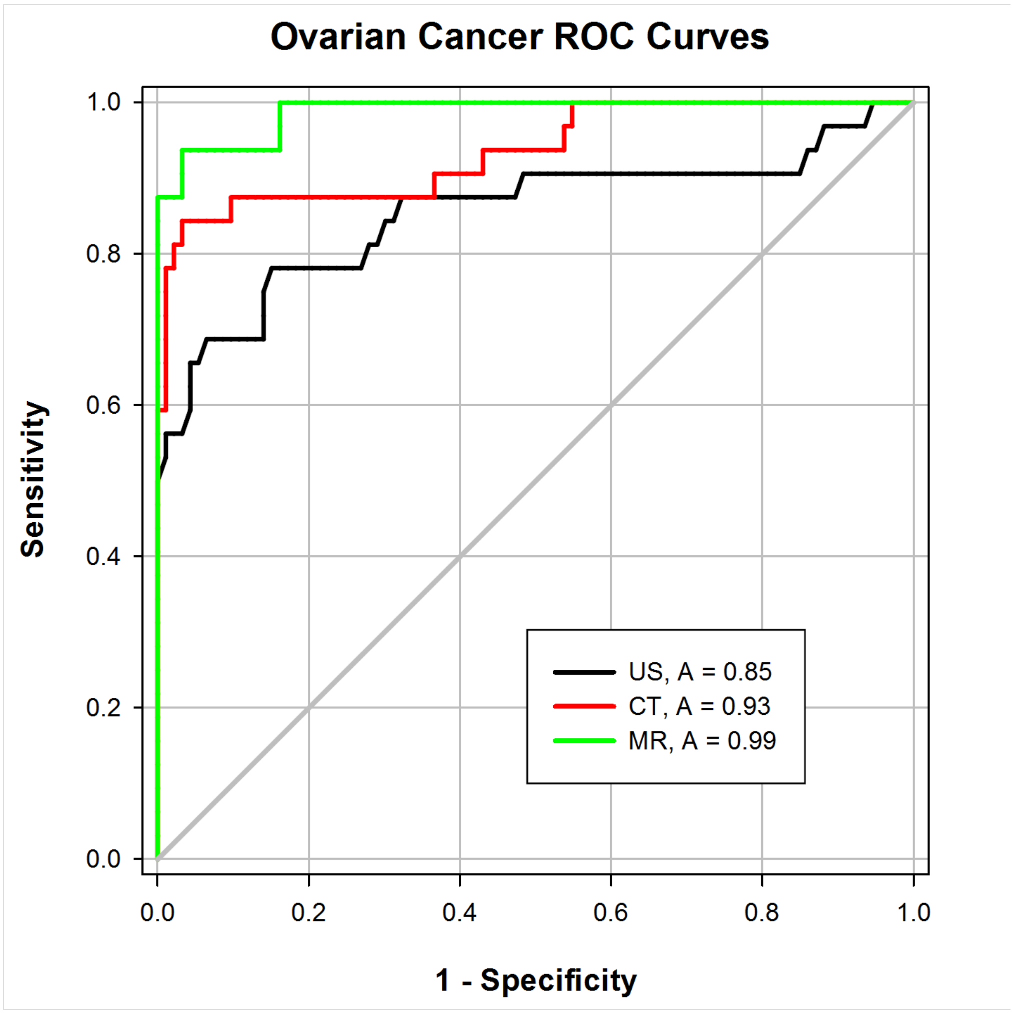
Typical results of the ROC analysis are shown in the following example from the Notebook Manager.



ROC Curves Graph

The ROC curves graph for three data sets is shown below. These graphs are derived from numerical results in the worksheet entitled Graph Data. The graph title is obtained from the section name containing the raw data. The legend shows the test names and the ROC areas for each curve. The diagonal line and grids options were selected for this graph.

Figure 120. The ROC curves graph for three tests.

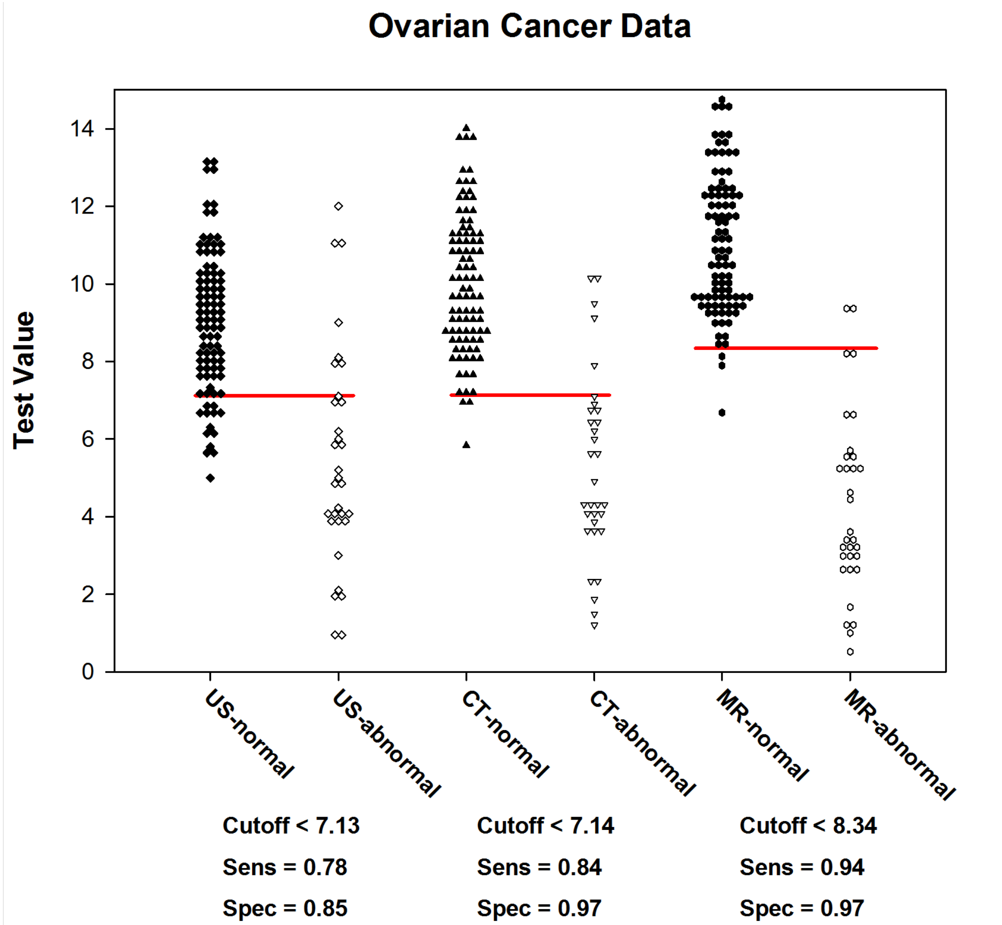


Of course, you can edit this graph in any way you wish. You might want to change the starting color of the color scheme used for the line colors.

Dot Histogram Graph

Dot histograms for the data associated with the ROC curves are shown below.

Figure 121. Dot Histogram Pairs for Each Test. The horizontal lines and the tables below the graph show the optimal cutoff values determined from the pre-test probability and cost ratio.



The graph title is obtained from the title of the section containing the raw data. The x-axis tick labels are obtained from the test names and the classification state names. The tick labels will rotate if they are too long to fit horizontally. The symbol layout design allows for symbols to touch horizontally and nest vertically.

If values for pre-test probability and false-positive/false-negative cost ratio are entered then the optimal cutoff values for each test are computed and represented as a horizontal line across the two dot histograms for each test. The numeric values for the optimal cutoff parameters are shown as tables below the x-axis.

Sensitivity and Specificity Report

The sensitivity and specificity report contains results for all tests with additional tests results placed in report rows below those of prior tests. The results for each test can be separated into three parts:

- Optimal cutoff value.
- Sensitivity and specificity versus cutoff values.
- Likelihood ratios and post-test probabilities.

If values for both pre-test probability and cost ratio have been entered then the optimal cutoff is calculated. A slope of the tangent to the ROC curve *m* is defined in terms of the two entered values (P = pre-test probability).

$$m = \left(\frac{\mathrm{Cost}_{\text{False Positive}}}{\mathrm{Cost}_{\text{False Negative}}}\right)\left(\frac{1-P}{P}\right)$$

The optimal cutoff value is computed from sensitivity and specificity using the slope m by finding the cutoff that maximizes the function

$$Sensitivity - m(1 - Specificity)$$

The results of this computation in the Sensitivity and Specificity Report are shown below.

Figure 122. Optimal Cutoff Results in the Sensitivity and Specificity Report

Optimal Operating Point	
Pre-test Probability	0.5000
Cost Ratio	1.0000
Cutoff <	7.1250
Sensitivity	0.7813
Specificity	0.8495

For this data set, the optimal cutoff is 7.125 for a pre-test probability of 0.5 and cost ratio of 1.0.

Sensitivities, specificities and their confidence intervals are listed as a function of cutoff value in the second part of the report. A portion of these results is shown in the table below. These results can be expressed as fractions or percents by using the Fractions/Percents option.

Figure 123. Sensitivity and specificity results in the Sensitivity and Specificity report.

Cutoff <	Sensitivity	95% CI	Specificity	95% CI
0.9500	0.0313	0.000791 to 0.1622	1.0000	0.9611 to 1.000
1.4500	0.0625	0.007661 to 0.2081	1.0000	0.9611 to 1.000
1.9500	0.0938	0.01977 to 0.2502	1.0000	0.9611 to 1.000
2.0500	0.1250	0.03513 to 0.2899	1.0000	0.9611 to 1.000
2.5500	0.1563	0.05275 to 0.3279	1.0000	0.9611 to 1.000
3.4000	0.1875	0.07208 to 0.3644	1.0000	0.9611 to 1.000
3.8500	0.2188	0.09277 to 0.3997	1.0000	0.9611 to 1.000
3.9250	0.2500	0.1146 to 0.4340	1.0000	0.9611 to 1.000
3.9750	0.2813	0.1375 to 0.4675	1.0000	0.9611 to 1.000
4.0250	0.3125	0.1612 to 0.5001	1.0000	0.9611 to 1.000
4.0750	0.3438	0.1857 to 0.5319	1.0000	0.9611 to 1.000
4.1250	0.3750	0.2110 to 0.5631	1.0000	0.9611 to 1.000
4.1750	0.4063	0.2370 to 0.5936	1.0000	0.9611 to 1.000
4.5000	0.4375	0.2636 to 0.6234	1.0000	0.9611 to 1.000
4.8500	0.4688	0.2909 to 0.6526	1.0000	0.9611 to 1.000
4.9500	0.5000	0.3189 to 0.6811	1.0000	0.9611 to 1.000
5.1000	0.5313	0.3474 to 0.7091	0.9892	0.9415 to 0.9997
5.4000	0.5625	0.3766 to 0.7364	0.9892	0.9415 to 0.9997
5.6500	0.5625	0.3766 to 0.7364	0.9785	0.9245 to 0.9974

The third part of the Sensitivity and Specificity report contains the likelihood ratios and post-test probabilities.

The positive and negative likelihood ratios are defined respectively as

$$LR+ = \frac{\text{Probability of a positive test given the presence of disease}}{\text{Probability of a positive test given the absence of disease}} = \frac{Sensitivity}{1 - Specificity} \quad LR- = \frac{\text{Probability of a negative test given the presence of disea}}{\text{Probability of a negative test given the absence of diseas}}$$

The post-test probabilities are the probability of disease given a positive test (PV+) and the probability of no disease given a negative test (PV-). These will be computed when a pre-test probability has been entered. Using P = pre-test probability, the equations used for these probabilities are:

$$PV = \frac{Sensitivity\ x\ P}{Sensitivity\ x\ P + (1 - Specificity)\ x\ (1 - P)} \quad PV- = \frac{Specificity\ x\ (1 - P)}{Specificity\ x\ (1 - P) + (1 - Sensitivity)\ x\ P}$$

A portion of the report showing the likelihood and post-test probabilities results is shown below.

Figure 124. Positive and Negative Likelihood Ratios, LR+ and LR-, and Post-test Probabilities, PV+ and PV-, in the Sensitivity and Specificity Report

	1	2	3	4
1	ROC Curve Areas			
2	Paired Analysis, Pairwise Deletion			
3				
4	Test Variables	Albumin	Total Protein	Total Score
5	ROC Curve Area	0.7188	0.6478	0.6869
6	Standard Error	0.0928	0.1000	0.1051
7	95% Confidence Interval	0.5368 to 0.9007	0.4518 to 0.8439	0.4809 to 0.8929
8	P Value	0.0269	0.1364	0.0536
9	Sample Size - success	12	12	12
10	Sample Size - failure	32	31	37
11	Missing - success	0	0	0
12	Missing - failure	5	6	0
13				
14	ROC Curve Area Comparison			
15				
16	Pair	Albumin, Total Protein	Albumin, Total Score	Total Protein, Total Score
17	Area Difference	0.0709	0.0318	-0.0391
18	Standard Error	0.0560	0.0980	0.1069
19	95% Confidence Interval	-0.0389 to 0.1807	-0.1603 to 0.2240	-0.2485 to 0.1704
20	ChiSquare, DF = 1	1.6020	0.1053	0.1338
21	P Value	0.2057	0.7456	0.7145

The positive likelihood ratio is not defined for some cutoff values since specificity = 1.

ROC Areas Report

The ROC Area report consists of two parts:

- ROC areas and their associated statistics.
- Pairwise comparison of ROC areas.

An example of a report is shown in below.

Figure 125. An Example ROC Areas Report. From top to bottom it shows the type of analysis used together with the missing value method, the ROC areas and associated statistics and a pairwise comparison of ROC areas.

	1	2	3	4
1	ROC Curve Areas			
2	Paired Analysis, Pairwise Deletion			
3				
4	Test Variables	Albumin	Total Protein	Total Score
5	ROC Curve Area	0.7188	0.6478	0.6869
6	Standard Error	0.0928	0.1000	0.1051
7	95% Confidence Interval	0.5368 to 0.9007	0.4518 to 0.8439	0.4809 to 0.8929
8	P Value	0.0269	0.1364	0.0536
9	Sample Size - success	12	12	12
10	Sample Size - failure	32	31	37
11	Missing - success	0	0	0
12	Missing - failure	5	6	0
13				
14	ROC Curve Area Comparison			
15				
16	Pair	Albumin, Total Protein	Albumin, Total Score	Total Protein, Total Score
17	Area Difference	0.0709	0.0318	-0.0391
18	Standard Error	0.0560	0.0980	0.1069
19	95% Confidence Interval	-0.0389 to 0.1807	-0.1603 to 0.2240	-0.2485 to 0.1704
20	ChiSquare, DF = 1	1.6020	0.1053	0.1338
21	P Value	0.2057	0.7456	0.7145

In this case there are three correlated tests. Row two of the report shows that a Paired Analysis was performed and, since there were missing values in the data, Pairwise Deletion of missing values was selected to compare the areas.

The first section of the report shows the ROC curve areas for the three tests. This is followed by the standard error of the area estimate, the 95% confidence interval (90% and 99% are also available) and the P value that determines if the area value is significantly different from 0.5. The sample size and the number of missing values for each classification state are given. The number of missing values reflects only what is seen in the data and does not give the number used for each computation-pair in the pairwise-deleted comparison of areas.

The second section shows the results of the pairwise comparison of areas. The method of DeLong, DeLong and Clarke-Pearson(2) is used to compare areas when the Paired data type option is selected. When the Unpaired data type is selected, areas are compared using a Z test. The report shows results for all pairs of data sets. The difference of each area pair and its standard error and 95% confidence interval are computed. This is followed by the chi-square statistic for the area comparison (or Z statistic if Unpaired is selected) and its associated P value.

Formatted Full Precision Display

This report presents the numeric results in a four significant digit format with full precision available. Double click on any cell (except the confidence intervals) to display the number at full precision.

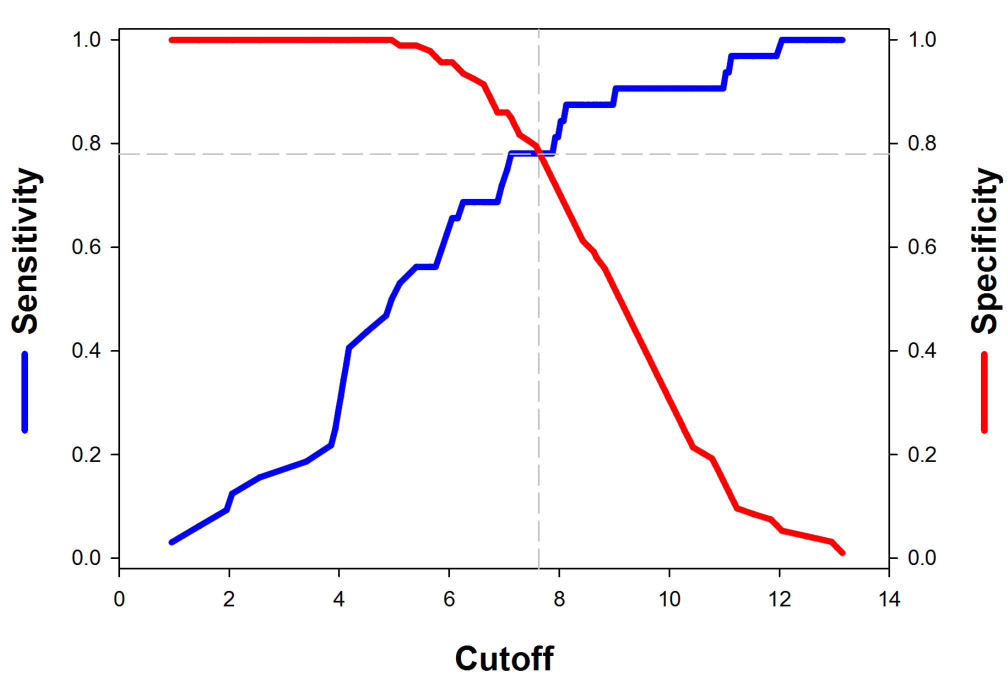
Additional Graphs

Results data in both reports can be used to create additional graphs. Some examples seen in the literature are shown here.

Sensitivity and Specificity versus Cutoff

The data for the graph in the graph below is from the Sensitivity & Specificity report in columns 1, 2 and 4. Use the Data Sampling option in Graph Properties, Plots, Data to specify the row range for the graph (you can also drag select the rows in the worksheet to do this).

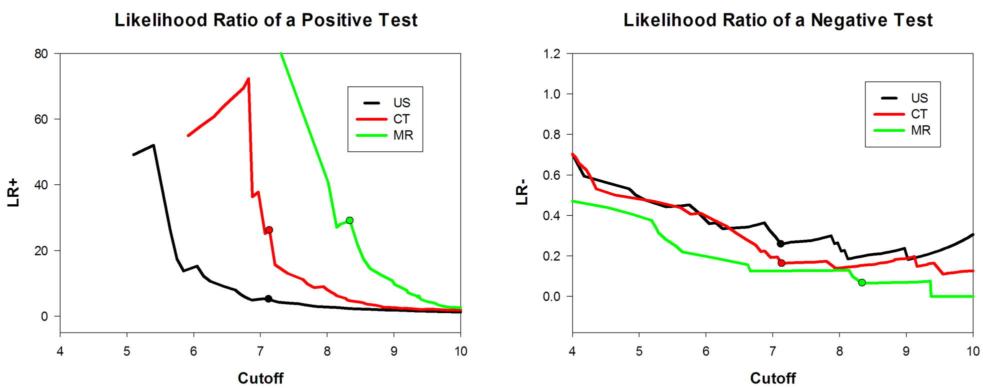
Figure 126. Graph of Sensitivity and Specificity versus Cutoff for One Test Using Data from Columns 1,2 and 4 of the Sensitivity and Specificity Report



Likelihood Ratios

The positive and negative likelihood ratios for three different imaging modalities are shown in below (the data is artificial). The data is in columns 1, 6 and 7 of the Sensitivity & Specificity report. The values associated with the optimal cutoff are shown as solid symbols. The largest positive likelihood and smallest negative likelihood at the optimal cutoff is associated with magnetic resonance imaging (MR).

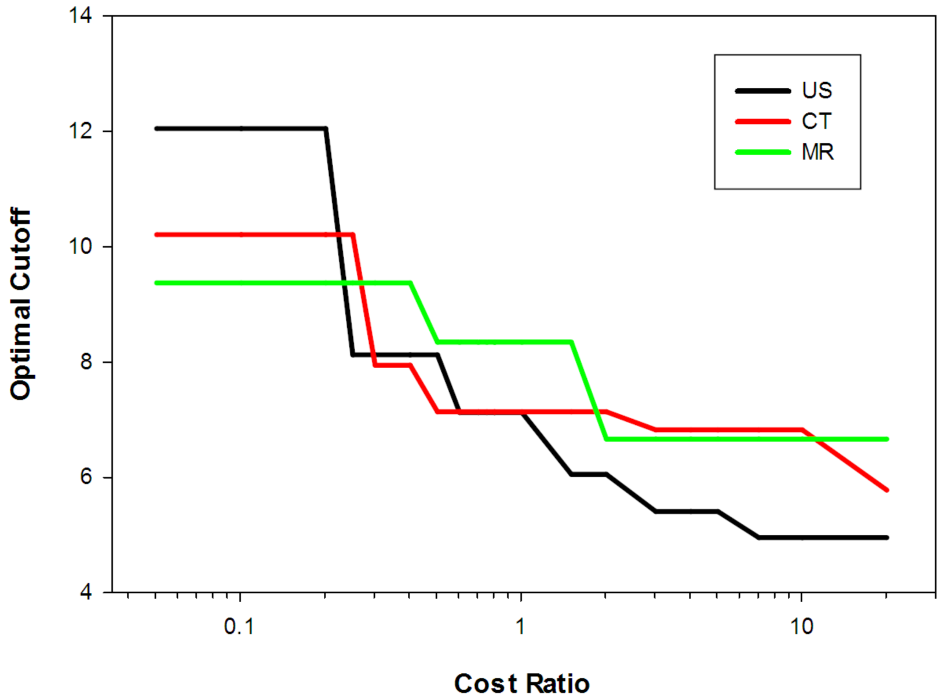
Figure 127. Positive and negative likelihood ratios graphed from data in the Sensitivity and Specificity report from columns 1, 6 and 7. The results for three tests are shown together with values associated with the optimal cutoff (solid symbols).



Optimal Cutoff versus Cost Ratio

Frequently it can be difficult to determine a value for the false-positive/false-negative cost ratio. So it is worth performing a sensitivity analysis (sensitivity here means how much one variable changes with changes in a second variable) to see whether the cutoff value changes significantly in the range of cost-ratio values of interest. The ROC Curves Module was run multiple times for different cost ratios and a graph of optimal cutoff vs. cost ratio for the three imaging modality tests is shown below.

Figure 128. Optimal cutoff values obtained from multiple runs of the macro. Regions of insensitivity, or strong sensitivity, to cost ratio can be identified.

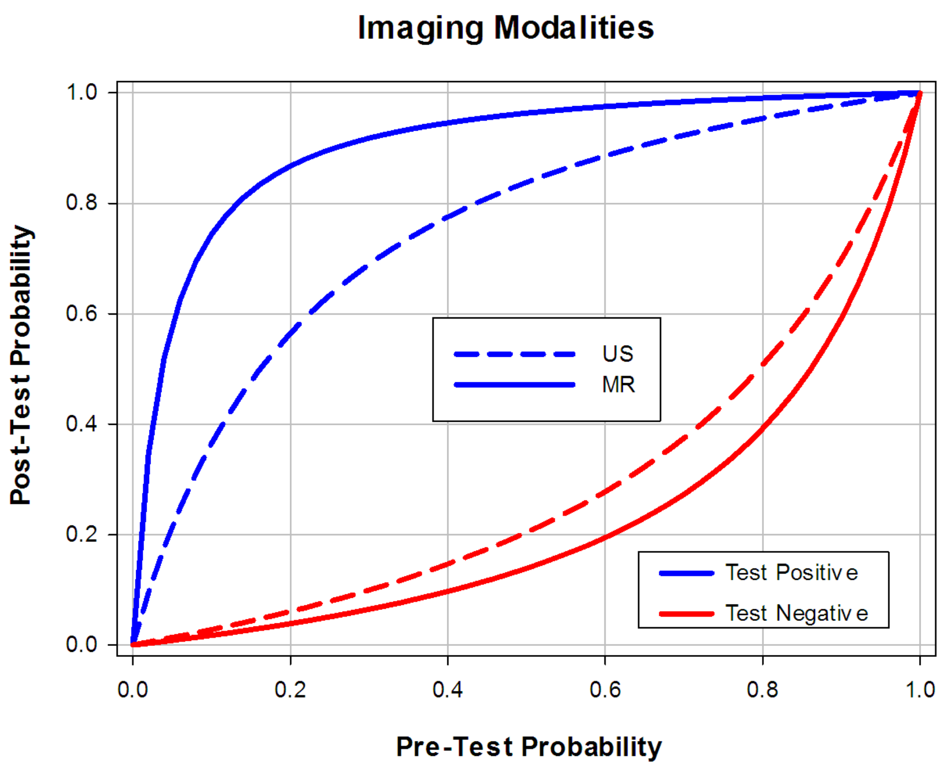


If the relative cost of a false-positive is much greater than that of a false-negative then the cost ratio is greater than 1. But let's assume that we don't know exactly how much greater it is but have some idea that it should be in the range of 2 to 5, say. Looking at the optimal cutoff for the best imaging modality (MR, green line) we find that it doesn't change for cost ratios from 2 to 20. So the optimal cutoff is insensitive to cost ratio and, in this case, it is not important to know a precise value for cost-ratio.

Post-Test Probability Versus Pre-Test Probability

Given values of sensitivity and specificity associated with the optimal cutoff a graph of post-test probabilities as a function of pre-test probability can be created using the equations below. The post-test probability of disease when the test is positive, blue lines in the graph below, was obtained from equation and the post-test probability of disease when the test was negative, red lines, was obtained from 1.0 minus equations PV+ and PV- above. A transform was written in SigmaPlot implementing these two equations that generated the post-test probabilities for a range of pre-test probabilities. The results for the best test, MR, and worst test, US, are shown. The MR test is clearly better since the post-test probability range, from negative test to positive test, is larger. Thus given a positive test the patient is more likely to have the disease using the MR test rather than the US test. Similarly, given a negative test it is less likely that the patient has the disease using the MR test.

Figure 129. Post-test probabilities of disease given positive and negative test results. The MR test is based on sensitivity = 0.94 and specificity = 0.97 whereas the US test used sensitivity = 0.78 and specificity = 0.85.



References

1. DeLong, ER, DeLong, DM, Clarke-Pearson, DL. *Comparing the areas under two or more correlated receiver operating characteristic curves: a nonparametric approach.* Biometrics 1988;44, 837-845.
2. Hanley, JA, McNeil, BJ. *The meaning and use of the area under a receiver operating characteristic (ROC) curve.* Radiology 1982, 143, 29-36.

Standard Curve

A standard curve is used to calibrate an instrument or assay. The Standard Curves macro provides five equations that may be fit to your data. These range from a straight line equation to two different five parameter logistic equations.

The X data may or may not be logarithmic and, if not, may still be graphed logarithmically. Multiple Y replicate columns may be used.

Predicted values may be obtained after the curve fit is performed: Y values from Xs, X values from Ys, and ECxx values from xx percentages. These predicted values may be added to your graph as symbols with drop-lines to the X and Y axes.

The Dynamic Curve Fitting algorithm may be used to help solve difficult curve fitting problems involving local minima.These are typically encountered with the five parameter logistic functions.

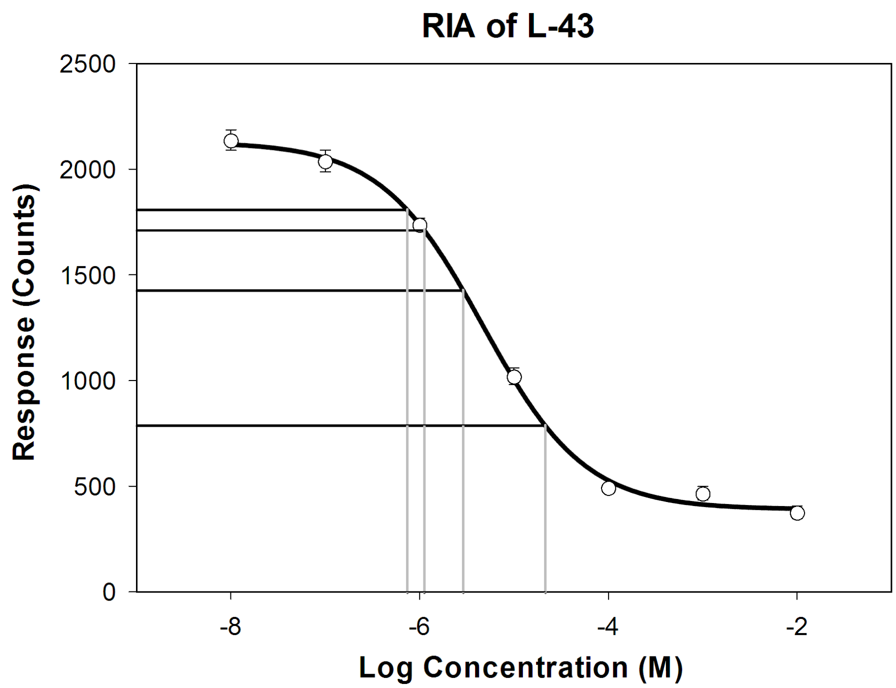
Using the Standard Curve Macro

To use the Standard Curve Macro:

1. Enter either X and Y columns or X and multiple replicate Y columns into your worksheet. These columns must be adjacent. If you plan to compute predicted Xs or Ys from the computed curve, you will also need to enter a column of the source values.
2. Select the equation from the Equation list to use to fit the curve. Your options are: straight line or quadratic equation; four parameter logistic equation; five parameter logistic equation; five parameter logistic equation – 2 slopes.
3. Select whether or not to plot the X axis using a common log scale
4. If you find that your data is difficult to fit, select the **Dynamic curve fit**. In this case 200 curve fits will be performed using initial starting values that span the parameter ranges. The best fit will be selected from the 200 results.
5. Set the columns to use for the X and Y data. If your X data us already in a log format, make sure you check the Log format X data option.
6. If you have replicate Y measurements for each X data point then select the **Y replicates** and then select the Last Y replicate column.
7. Select **Predict unknowns** to compute results using the solution to the fit. You can compute a column of new Y values from given Xs, or Xs from given Y values. If you are using the four or five parameter logistic equations you can compute ECpercent values for a specified range of percent values. You can also elect to plot the results of these on your standard curve.

8. When finished, click **OK**. A standard curve appears, and if you elected to compute additional values, they are also plotted using drop lines to indicate the X and Y values.

Figure 130. A Standard Curves Graph



Y Replicates

If you have multiple measurements for each X value, select **Y replicates** on the **Standard Curve** dialog box, then select the **Last Y replicate column** from the drop-down list. The Y replicate columns must begin to the right of the X data.

Figure 131. Y Replicate Data for the Standard Curves Macro

Replicate Data*

	1-Conc	2-standard 1	3-standard 2	4-standard 3	5	6-unknown 2
1	1.0000e-7	271.0000	250.0000	115.0000		1455.0000
2	1.0000e-6	208.0000	358.5000	365.0000		1694.0000
3	1.0000e-5	651.0000	552.0000	630.0000		1801.0000
4	1.0000e-4	1361.0000	1377.0000	1261.0000		790.0000
5	1.0000e-3	1861.0000	1877.0000	1830.0000		500.0000
6	0.0100	1840.0000	1945.0000	1865.0000		400.0000
7	0.1000	2023.0000	1977.0000	1919.5000		
8						

Log Data Format

If your X data uses simple integers, especially negative numbers, it is already in log format and you should select the Log format X data option. The macro will automatically create a new column of equivalent numeric data, and automatically plot X on a log axis scale.

Figure 132. Log Data Format for the Standard Curves Macro

Replicate Data, LogX

	1-log Conc	2-standard 1	3-standard 2	4-standard 3	5	6-unknown 2
1	-7.0000	271.0000	250.0000	115.0000		1455.0000
2	-6.0000	208.0000	358.5000	365.0000		1694.0000
3	-5.0000	651.0000	552.0000	630.0000		1801.0000
4	-4.0000	1361.0000	1377.0000	1261.0000		790.0000
5	-3.0000	1861.0000	1877.0000	1830.0000		500.0000
6	-2.0000	1840.0000	1945.0000	1865.0000		400.0000
7	-1.0000	2023.0000	1977.0000	1919.5000		
8						

Linear Equation

$$y = y_0 + ax$$

A straight line, characterized by the slope *a* and the *y*-intercept y_0.

Quadratic Equation

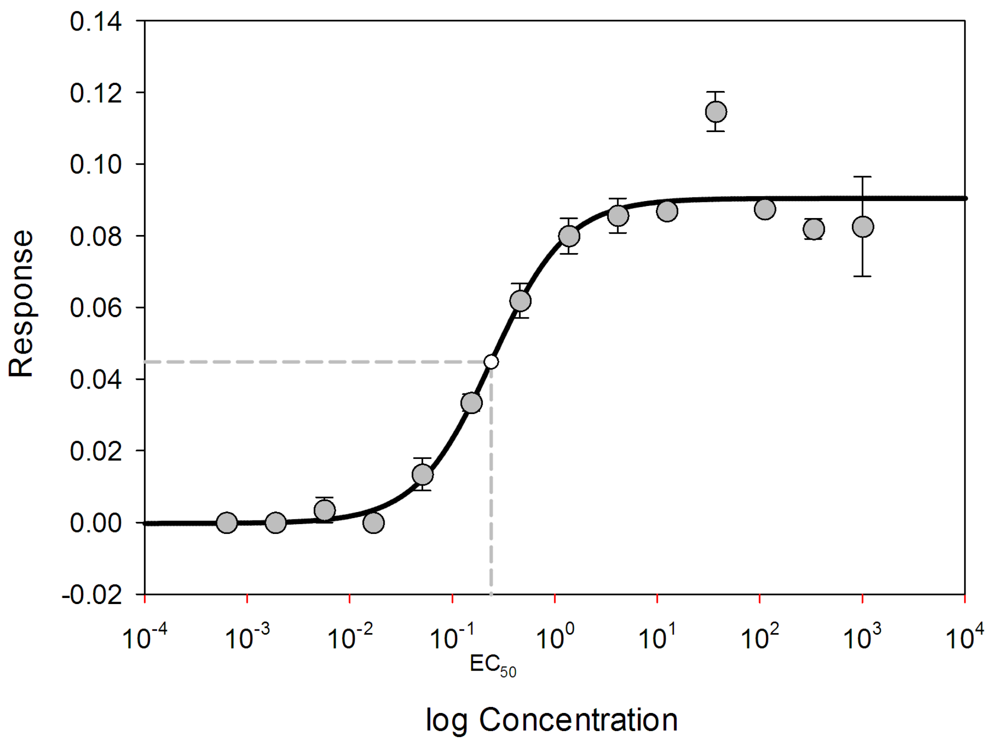
$$ax^2 + bx + c = 0$$

The standard parabolic equation with quadratic coefficient *b*, slope a and intercept y_0.

Four Parameter Logistic Equation

$$y = min + \frac{max - min}{1 + \left(\frac{x}{EC50}\right)^{-Hillslope}}$$

Figure 133. A Dose-Response Curve with a Variable Slope Parameter



This is a typical dose-response curve with a variable slope parameter. Four parameters are produced:

- **Min**, or bottom of the curve.
- **Max**, or top of the curve.
- **EC50**: Median effective concentration. That is, the concentration that can be expected to cause a defined effect on 50% of a given population of organisms under defined conditions.
- **Hillslope:** Characterizes the slope of the curve at its midpoint.

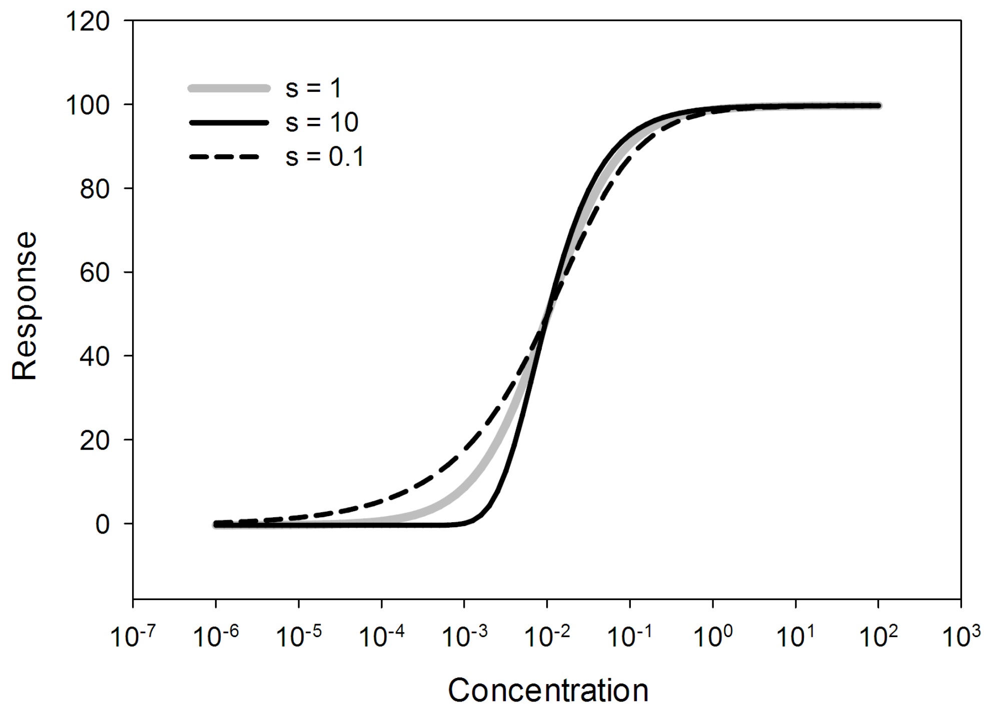
Five Parameter Logistic Curve

$$y = min + \frac{max - min}{\left(1 + \left(\frac{x}{x_b}\right)^{-Hillslope}\right)^s}$$

where

$$x_b = EC_{50}\left[10\left[\left(\frac{-1}{Hillslope}\right)\log\left(2^{\left(\frac{1}{s}\right)} - 1\right)\right]\right]$$

Figure 134. Richard's Formulation of the Five Parameter Logistic



This is the Richard's formulation of the five parameter logistic. It adds an asymmetry parameter *s* to the four parameter logistic. The asymmetry is shown above with large changes in curvature with changes in *s* in the lower curve but relatively small changes in the upper curve.

The additional algebraic equation for x_b maintains EC_{50} as the half-maximum y value. The equation has been written so that a positive Hillslope results in a curve that increases with *x*.

Four of the five parameters are the same as those in the four parameter logistic.

s controls the asymmetry. If *s* = 1 then this function is the same as the four parameter logistic. *s* less than 1 decreases the overall slope of the curve whereas *s* greater than 1 increases the overall slope.

Five Parameter Logistic – Two Slopes

$$y = min + \frac{max - min}{1 + f_x\left(\frac{x}{EC_{50}}\right)^{-Slope_1} + (1 - f_x)\left(\frac{x}{EC_{50}}\right)^{-Slope_2}}$$

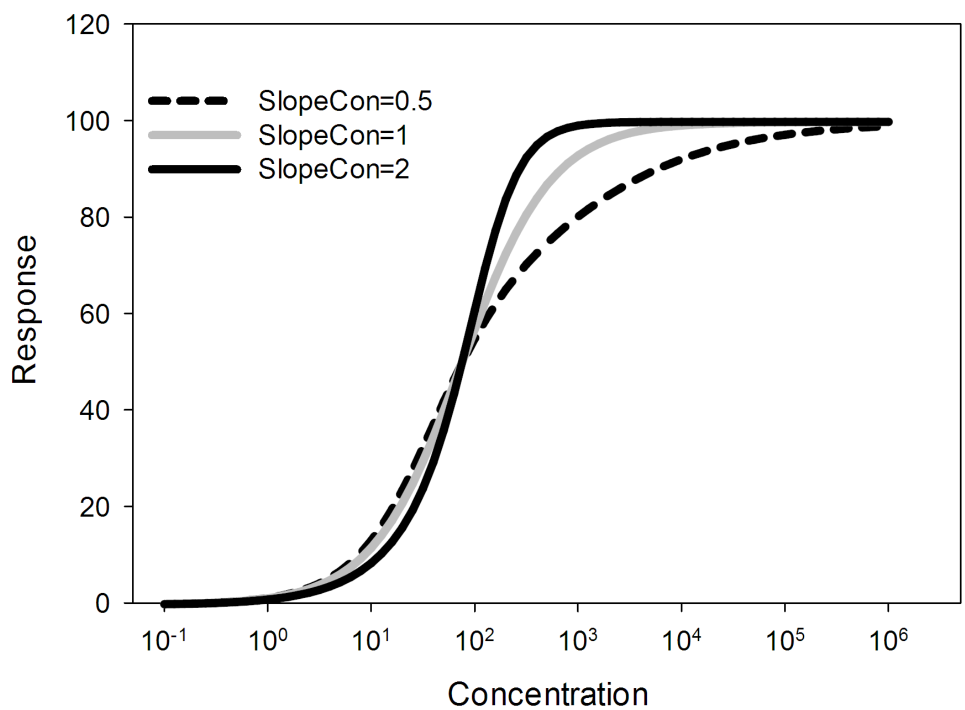
where

$$Slope_2 = Slope_1 SlopeCon, SlopeCon > 0$$

$$fx = \frac{1}{1 + (\frac{x}{EC_{50}})^{C_f}}$$

$$C_f = \frac{2 Slope_1 Slope2}{|Slope_1 + Slope_2|}$$

Figure 135. Ricketts and Head Equation with Two "Slope" Parameters



This is the Ricketts and Head equation with two "slope" parameters (the parameters actually better describe the two different curvatures). It has a different shape than Richard's equation and will fit some data sets better. The equation is written in terms of SlopeCon to force Slope1 and Slope2 to be the same sign.If this is not the case then in rare situations, error in the data will result in a fit with slopes of opposite sign.In this case the function attempts to follow the error which results in an irregularly shaped curve. The graph shows the increasing asymmetry with increasing SlopeCon (and therefore increasing Slope2). If SlopeCon=1 then Slope1 = Slope2 and the curve is symmetric and identical to the four parameter logistic curve.

References

1. Richards, F.J. *A flexible growth function for empirical use.* J. Exp. Botany 10. pp290-300.
2. Ricketts, J.H. and G. Head. *A five-parameter logistic equation for investigating asymmetry of curvature in baroreflex studies.* Am. J. Physiol. 277 (Regulatory Integrative Comp. Physiol. 46). R441-R454. 1999.

Survival Curve

This macro computes and graphs a Kaplan-Meier survival curve. Specify the column containing the survival data, as well as the column indicating censoring of cases. A value of 0 in the censoring column indicates that the case is censored, whereas a value of 1 indicates an uncensored case.

Use the Graph Titles section of the Survival Curve dialog box to customize the graph title, the X axis title and the Y axis title. Further customize the plot by selecting between a built-in symbol and a half-line symbol for censored observations.

The macro writes the data underlying the plot in seven worksheet columns, beginning in the specified location. The first three result columns contain the time, cumulative probability, and standard error of the cumulative probability. The next two columns hold the coordinates of the censored observations. The final two columns contain the coordinates of the half-lines used to depict the censored observations.

Restriction:

- To run the macro, a worksheet must be open and in focus.
- The worksheet must be sorted by survival times.
- If identical survival times occur for both censored and uncensored cases, place the censored cases after the uncensored within the tied time value.

Vector Plot

This macro uses the vector transform to plot X,Y, angle and magnitude data as vectors with arrowheads. The arrowheads have a user-specified length and angle. The vector starting point may be selected as the point of the vector tail, midpoint or head. The vector plot consists of three line plots.

The data underlying these plots appears in the six columns of the worksheet immediately to the right of the data as three XY pairs.

Restriction:

- To run the macro, a worksheet must be open and in focus.
- The four columns to be plotted must be contiguous and in the following order: X, Y, Angle, and Magnitude (Length). Due to this restriction, only the first data column (X) must be specified.
- Angle data must be in radians.

Chapter 12. SigmaPlot Automation Reference

OLE Automation is a technology that lets other applications, development tools, and macro languages use a program. Using SigmaPlot Automation, you can integrate SigmaPlot with the applications you have developed. Automation can also be an effective tool to customize or automate frequent tasks you want to perform.

Automation uses objects to manipulate a program. Objects are the fundamental building block of macros; nearly all macro programs involve modifying objects. Every item in SigmaPlot - graphs, worksheets, axes, tick marks, reports, notebooks, and so on - can be represented by an object.

SigmaPlot uses a VBA®-like macro language to access automation internally. For more information, see Automating Routine Tasks *(on page 385)*.

About Objects and Collections

An *object* represents any type of identifiable item in SigmaPlot. Graphs, axes, notebooks, worksheets, and worksheet columns are all objects.

A *collection* is an object that contains several other objects, usually of the same type; for example, all the items in a notebook are contained in a single collection object. Collections can have methods and properties that affect the all objects in the collection.

Use properties and methods to modify objects and collections of objects. To specify the properties and methods for an object that is part of a collection, you need to return that individual object from the collection first.

For more information, refer to SigmaPlot Automation Help located on the Help menu.

About Properties

A *property* is a setting or other attribute of an object. Think of a property as an "adjective." For example, properties of a graph include the size, location, type and style of plot, and the data that is plotted.

To change the settings of an object, change the properties settings. Properties are also used to access the objects that are below the current object in the hierarchy.

To change a property setting, type the object reference followed with a period, then type the property name, an equal sign (=), and the property value.

Example

```
Set Notebook.Title = "My Notebook"
```

Sets the name of the referenced SigmaPlot notebook to **"My Notebook"**.

Note that some properties cannot be set, and only retrieved. The Help topic for each property indicates whether you can both set and retrieve that property (read-write), only retrieve the property (read-only), or only set the property (write-only).

You can get information about an object by returning the values of its properties.

Example

```
Set CurrentDoc = ActiveDocument.NotebookItems(3)
```

The fourth item in the current notebook (specified by `ActiveDocument`) is assigned to the variable `CurrentDoc` (item counts start with 0).

About Methods

A *Method* is an action that can be performed on or by an object. Think of methods as *verbs*. For example, the **WorksheetEditItem** object has **Copy** and **Clear** methods. Methods can have parameters that specify the action (*adverbs*).

For more information, refer to SigmaPlot Automation Help which you can find on the Help menu.

Example

```
Notebooks(0).NotebookItems(2).Close(True)
```

This example closes the second item in the **NotebookItems** collection object while saving it first. Note that the **NotebookItems** collection is selected using the **Notebooks** object **NotebookItems** property.

Returning Objects

In order to work with an object, you must be able to define the specific object by returning it. In general, most objects are returned using a property of the object above it in the object tree.

Returning Objects from Collections

Other objects are returned by specifying a single object from a collection. Once you define the collection, you can return a specific object by using an index value (as you would with an array). You can use either the Item method shared by all collections, or use the index directly. The index can be the item name or a number. For example:

```
Set Worksheet = Notebooks("My Notebook").NotebookItems.Item(2)
```

The collection index value returns the notebook **"My Notebook"** from the **Notebooks** collection, then the **Item** property and index number returns the third item from the **NotebookItems** collection as the variable **Worksheet**.

The **Notebooks** collection contains a list of all the open notebooks in SigmaPlot, and the **NotebookItems** collection contains all items in the specified notebook.

Defining Variables

You can also return and use objects by defining the object to be a variable, generally using the Dim (dimension) statement.

Although you can implicitly declare variables just by using the variable for the first time, you can avoid bugs caused by typos using Option Explicit. For example, the script:

```
Option Explicit


Sub Main

Dim ItemCount

Dim SPWorksheets$()

ItemCount = ActiveDocument.NotebookItems.Count

ReDim SPWorksheets$(ItemCount)

Dim SPItems

Set SPItems = ActiveDocument.NotebookItems

Dim Index

Index = 0

Dim Item

For Each Item In SPItems

If SPItems(Index).ItemType = 1 Then

      SPWorksheets$(Index) = SPItems(Index).Name

End If
```

```
Index = Index + 1
Next Item


Begin Dialog UserDialog 320,119,"Worksheets in Active Notebook" ' %GRID:10,7,1,1
      OKButton 210,14,90,21
      ListBox 20,14,170,91,SPWorksheets(),.ListBox1
End Dialog
Dim dlg As UserDialog
Dialog dlg
End Sub
```

Uses the Dim (Dimension) statement to define several variables, and uses the Set instruction to define a declared variable as an object.

Index

A

B

C

D

E

G

H

I

J

K

L

M

N

O

Q

R

S

T

U

V

W

X

Z