Grapher™

The ultimate technical graphing package.

User's Guide

Grapher™ Registration Information

Your **Grapher** product key is located in the email download instructions and in your account at MyAccount.GoldenSoftware.com.

Register your **Grapher** product key online at www.GoldenSoftware.com. This information will not be redistributed.

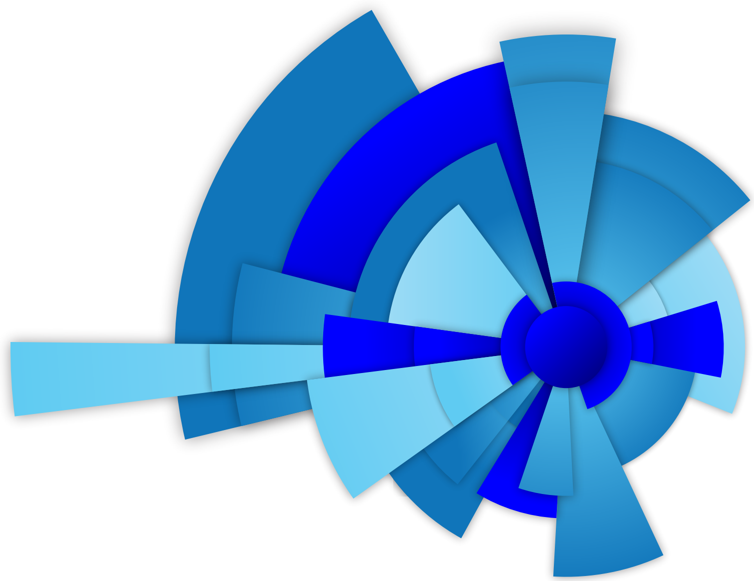
Registration entitles you to free technical support, download access in your account, and updates from Golden Software.

For future reference, write your product key on the line below.

____

Grapher™ User's Guide

The Ultimate Technical Graphing Package



Golden Software, LLC
809 14th Street, Golden, Colorado 80401-1866, U.S.A.
Phone: 303-279-1021 Fax: 303-279-0909
www.GoldenSoftware.com

COPYRIGHT NOTICE

March 2020

Contents

Chapter 1 - Introducing Grapher
Introduction to Grapher ... 9
New Features ... 12
Welcome to Grapher Help ... 12
Three-Minute Tour ... 16
Grapher User Interface ... 19
File Types ... 53
Plot Types ... 56
Creating Graphs ... 65
Register Your Software ... 68
Check for Update ... 68
Technical Support ... 69
Chapter 2 - Tutorial
Tutorial Introduction ... 71
Starting Grapher ... 72
Lesson 1 - Viewing and Editing Data ... 72
Lesson 2 - Creating a Graph ... 76
Lesson 3 - Editing Axes ... 83
Lesson 4 - Adding and Editing a Legend ... 89
Lesson 5 - Working with the Script Recorder ... 91
Chapter 3 - Data Files and the Worksheet
Data Overview ... 101
Worksheet Window ... 110
Chapter 4 - Creating Graphs
Creating Graphs ... 189
Graph Wizard ... 191
Graph Wizard - Select Data ... 192
Graph Wizard - Select Plot Type ... 194
Graph Wizard - Properties ... 198
Template Graphs ... 201
Chapter 5 - Basic Type Plots
Line, Scatter, and Line/Scatter Plots ... 205
Plot Page - Line, Scatter, and Line/Scatter Plots ... 206
Step Plots ... 211
Plot Page - Step Plots ... 213
Function Plots ... 217
Plot Page - Function Plots ... 219

Create Vertical Lines in a Graph 223
Bubble Plots 225
Plot Page - Bubble Plots 226
Class Scatter Plots 234
Plot Page - Class Scatter Plots 235
Edit Classes Dialog 240
Class Properties Dialog 244
3D Ribbon Plots and 3D Wall Plots 246
Plot Page - Ribbon/Wall Plots 247
3D Step Plots 251
Plot Page - Step Plots 252
3D XYZ Plots 257
Plot Page - Line, Scatter, and Line/Scatter Plots 259
3D Function Plots 263
Plot Page - Function Plots 265
XYZ Bubble Plots 269
Plot Page - Bubble Plots 270
XYZ Class Scatter Plots 278
Plot Page - Class Scatter Plots 279
Chapter 6 - Bar Type Plots
Horizontal Bar Charts and Vertical Bar Charts 285
Horizontal Category Bar Charts and Vertical Category Bar Charts 286
3D Bar Charts 288
XYZ Bar Charts 290
Bar Chart Multiple Variable Data Files 291
Plot Page - Bar Charts 294
Bar Chart Groups 305
Floating Bar Charts 307
3D Floating Bar Charts 309
XYZ Floating Bar Charts 310
Plot Page - Floating Bar Charts 311
Chapter 7 - Polar Type Plots
Polar Line Plot, Polar Scatter Plot, Polar Line/Scatter Plot 319
Plot Page - Polar Plots 320
Polar Class Scatter Plot 323
Plot Page - Class Scatter Plots 324
Edit Classes Dialog 329
Class Properties Dialog 333
Polar Vector Plots 335

Plot Page - Polar Vector Plots 336
Polar Function Plots 339
Plot Page - Polar Function Plots 340
Polar Bar Charts 342
Plot Page - Polar Bar Charts 343
Bar Chart Groups 347
Polar Rose Chart 349
Plot Page - Polar Rose Chart 351
Custom Bins 354
New Bin Range Dialog 356
Polar Wind Charts 357
Plot Page - Wind Charts 358
Wind Speed Bins 362
Radar Charts 364
Graph Page - Radar Plot 366
Chapter 8 - Ternary Plot Types
Ternary Line, Scatter, and Line/Scatter Plots 371
Reading Ternary Diagrams 372
Plot Page - Ternary Diagrams 375
Ternary Class Scatter Plots 377
Plot Page - Class Scatter Plots 379
Edit Classes Dialog 383
Class Properties Dialog 387
Ternary Bubble Plots 389
Plot Page - Bubble Plots 390
Piper Plot and Piper Class Scatter Plot 398
Graph Page - Piper Plots 400
Plot Page - Piper Diagrams and Durov Plots 401
Chapter 9 - Specialty Type Plots
High-Low-Close Plots 405
Plot Page - High-Low-Close Plots 406
Vector Plots 410
XYZ Vector Plots 411
Plot Page - Vector Plots 413
Stiff Plot 417
Plot Page - Stiff Plots 419
Chapter 10 - Statistical Type Plots
Histogram Plots 423
3D Histogram Plots 424

Plot Page - Histogram Plots 425
Set Image Dialog 433
Custom Bins 435
New Bin Range Dialog 437
Box Plots 439
Box Plot Data 441
Plot Page - Box Plots 442
Labels Page - Box Plots 448
Pie Charts 452
3D Pie Charts 453
Plot Page - Pie and Doughnut Charts 455
Slices Properties 460
Labels Page - Pie Charts and Doughnut Plots 462
Title Properties 464
Q-Q Plots and Normal Q-Q Plots 468
Plot Page - Q-Q and Normal Q-Q Plots 469
Doughnut Plots 472
3D Doughnut Plots 473
Plot Page - Pie and Doughnut Charts 475
3D Settings - Graph Objects 481
Chapter 11 - Contour and Surface Type Plots
Contour Data Map 485
Plot Page - Contour Data Maps 486
Grid Properties - Contour Maps 489
Inverse Distance to a Power 492
Producing a Surface or Contour Map from a Regular Array of XYZ Data 494
Contour Grid Map 495
Plot Page - Contour Grid Maps 496
Contour Function Map 499
Plot Page - Contour Function Maps 500
Color Scale - Contour Maps 503
Levels - Contour Maps 506
Levels - Contour Maps 509
Set Level - Contour Maps 513
Surface Data Map 513
Plot Page - Surface Data Maps 514
Grid - Surface Maps 518
Surface Grid Map 521

Plot Page - Surface Grid Maps 522
Surface Function Map 526
Plot - Surface Function Maps 527
Lighting Properties 531
Color Scale - Surface Maps, Vector Plots, Color Mapped Symbols 533

Chapter 12 - Fit Curves and Confidence Intervals

Fit Curves 537
Available Fits 537
Orthogonal Polynomial Regression 541
Orthogonal Polynomial Regression References 544
Define Fit Equation 545
Plot Page - Fit Plots 546
Fit Statistics 554
Statistics References 558
Confidence Intervals 558
Plot - Confidence 560

Chapter 13 - Common Plot Properties

Error Bars 563
Clipping 569
Plot Labels 582
Symbol Properties 606
Color Gradient 615
Line Properties 627
Line Palette 633
Line Styles 633
Fill Properties 639
Fill Palette 646
Fill Patterns 646
Color Table 650
Color Palette 652
Custom Colors - Standard Page 653
Custom Colors - Custom Page 655
Set Image Dialog 657

Chapter 14 - Graph Properties

Graph Properties 659
Title Properties 659
Move Labels 662
Fill Properties - Graph 664
Add to Graph 668

Legends 677
Summation Plots 691
Magnifier 696
Digitizing 699
Convert Graph or Plot 703
Calculate Area 704
Chapter 15 - Axis Properties
Axis Types 707
Standard Axes 709
Axis Properties 710
Position Axis 717
Angle Axes 719
Axis Properties - Angle Axis 720
Stiff Plot Axes 724
Box Plot Axes 725
Grid Lines 726
Tick Marks 729
Tick Labels 735
Link Axis 746
Date Time Labels 757
Worksheet Labels 765
Ternary Axes Tips 768
Axes Limits Dialog 769
Hiding Axes 770
Creating Multiple Graphs on a Page 771
Chapter 16 - Creating, Selecting, and Editing Objects
Creating Drawing Objects 773
Selecting Objects 790
Object Properties 793
Altering the View 847
Editing 857
Arrange 864
Chapter 17 - Importing, Exporting, and Printing Graphs and Graphics
Import 877
Export 898
Printing 908
Chapter 18 - Options, Defaults, and Customizations
Options 913

Options - General 913
Options - Updates 919
Options - Backup 920
Options - Display 921
Tabbed Documents 924
Options - Rulers and Grid 924
Options - Selection 926
Options - Plots 927
Options - Dialog Messages 930
Options - Defaults 931
File | Defaults 932
Customizing Commands 935
Chapter 19 - Automating Grapher
Scripter 941
Scripter Windows 941
Working with Scripts 943
Writing Scripts 944
Running Scripts 945
Running Scripts from the Command Line 946
Debugging Scripts 947
Script Recorder 951
Custom Script Buttons 952
Object Browser 953
Type Library References 954
Scripter BASIC Language 955
Basic Language 955
Using Scripter Help 976
Suggested Reading - Scripter 977
Grapher Object Model 977
Overview of Grapher Objects 978
Using Grapher Objects 978
Object Hierarchy 979
Hierarchy - AutoGraph Object 982
983
Collections 984
Using Collection Objects 984
Derived Objects 985
Methods and Properties 986
Specifying Cell Coordinates 987

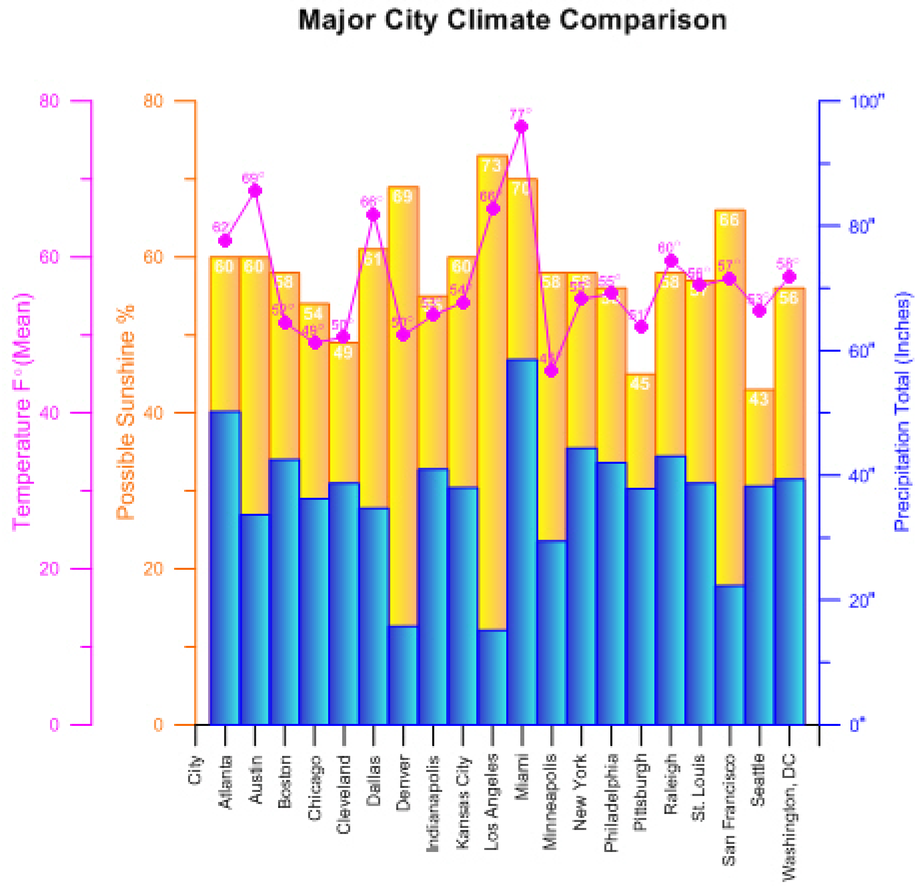
Appendix A - Functions
Functions ... 991
Mathematical Functions ... 991
Math Text Instruction Syntax ... 999
Color Spectrum File Format ... 1005
Appendix B - File Formats
File Format Chart ... 1007
Convert Older Grapher Files ... 1016
Import File Types ... 1016
File Descriptions ... 1017
Import Options ... 1087
Import Automation Options ... 1120
Export Options ... 1144
Export Automation Options ... 1179
Index

Chapter 1 - Introducing Grapher

Introduction to Grapher

Welcome to Grapher, the easy-to-use 2D & 3D technical graphing package for scientists, engineers, business professionals, or anyone who needs to generate publication quality graphs quickly and easily. Grapher is an efficient and powerful graphing program for all of your most complex graphing needs. Create exciting graphs and plots for presentations, papers, marketing, analysis, sales, and more.

With Grapher, creating a graph is as easy as choosing the graph type, selecting the data file, and clicking the Open button. Grapher automatically selects reasonable default settings for each new graph, though all of the graph settings can be modified. For example, you can change tick mark spacing, tick labels, axis labels, axis length, grid lines, line colors, symbol styles, and more. You can add legends, images, fit curves, and drawing objects to the graph. To apply the same custom settings to several graphs, you can create a Grapher template containing the preferred styles. Automate data processing and graph creation using Golden Software's Scripter program or any Active X automation program. Once the graph is complete, you can export it in a variety of formats for use in presentations and publications.



Grapher is extremely flexible. For example, you can combine multiple plot types, display graph titles, customize axis settings, and more.

System Requirements

The minimum system requirements for Grapher are:

- Windows 7 SP1, 8 (excluding RT), 10 or higher
- 512MB RAM minimum for simple data sets, 1GB RAM recommended
- At least 500MB free hard disk space
- 1024x768 or higher monitor resolution with a minimum of 16-bit color depth

Installing Grapher

Installing Grapher requires Administrator rights. Either an administrator account can be used to install Grapher, or the administrator's credentials can be entered before installation while logged in to a standard user account. If you wish to use a Grapher single-user license, the product key must be activated while logged in to the user account under which

Grapher will be used. For this reason, we recommend logging into Windows under the account for the Grapher user, and entering the necessary administrator credentials when prompted.

Golden Software does not recommend installing Grapher in the same location as any previous version of Grapher. Grapher can coexist with older versions as long as they are installed in different directories.

To install Grapher from a download:

1. Log into Windows under the account for the individual who is licensed to use Grapher.
2. Download Grapher according to the emailed directions you received or from the **My Products** page of the Golden Software My Account portal.
3. Double-click on the downloaded file to begin the installation process.
4. Once the installation is complete, run Grapher.
5. License Grapher by activating a single-user license product key or connecting to a license server.

Uninstalling Grapher

To uninstall Grapher, follow the directions below for your specific operating system. We recommend deactivating your license prior to uninstalling Grapher if you are using a single-user license.

Windows 7

To uninstall Grapher, go to the *Windows Control Panel* and click the *Uninstall a program* link. Select Grapher from the list of installed applications. Click the *Uninstall* button to uninstall Grapher.

Windows 8

From the *Start* screen, right-click the Grapher tile and click the *Uninstall* button at the bottom of the screen. Alternatively, right-click anywhere on the *Start* screen and click *All apps* at the bottom of the screen. Right-click the Grapher tile and click *Uninstall* at the bottom of the screen.

Windows 10

Select *Settings* in the **Start** menu. In *Settings*, select **Apps | Apps & features**. Select Grapher, and then click *Unistall*. To uninstall Grapher from the Windows Control Panel, click **Programs | Programs and Features**. Next select Grapher and click *Uninstall*.

Grapher Trial Functionality

The Grapher trial is a fully functioning time-limited trial. This means that commands work exactly as the commands work in the full program for the duration of the trial. The trial has no further restrictions on use. The trial can be installed on any computer that meets the system requirements. The trial can be licensed by activating a product key or connecting to a license server.

Scripter

The Scripter program, included with Grapher, is useful in creating, editing, and running script files that automate Grapher procedures. By writing and running script files, simple mundane tasks or complex system integration tasks can be performed precisely and repetitively without direct interaction. Grapher also supports ActiveX Automation using any compatible client, such as Visual BASIC. The automation capabilities allow Grapher to be used as a data visualization and graph generation post-processor for any scientific modeling system.

The script recorder records commands in a script as you perform them in Grapher. Run the script, and Grapher repeats the steps. This is ideal for users that need to perform repetitive tasks but are unfamiliar with automation or for advanced users who do not want to manually enter all of the syntax.

New Features

We release new features in updates all the time. To see the latest features, visit What's New in Grapher Preview and What's New in Grapher at the Golden Software Knowledge Base.

Welcome to Grapher Help

You can obtain help in **Grapher** in several ways:

Getting Help

Within **Grapher**, the online help file is opened by clicking the **Home | Help | Contents** command, the **Home | Help | Tutorial** command, the **Automation | Help | Grapher Automation Help** command, or the button in the upper right corner of the program. You can also quickly search the help by typing a term in the command and help search above the ribbon and clicking *Search help file* in the results list. Alternatively, press F1 at anytime to open the help file.

In **Scripter, Grapher's** help file is opened by clicking the **Help | Grapher Automation Help** command.

Navigating the Help

You can navigate the help file using the **Contents**, **Index**, **Search**, and **Favorites** pages in the navigation pane to the left of the topic page. he navigation pane is displayed by default.

The navigation pane can be displayed by clicking the button and hidden with the button.

- The **Contents** page allows you to search the predefined table of contents. The table of contents has a variety of help books and help topic pages. Double-click on a help book name or click the button to open the book.
- The **Index** page allows you to search index words to find a help topic. If you do not find a topic with an index word, try a search on the **Search** page.
- The **Search** page offers advanced search options including phrases, wildcards, boolean, and nested searching.
- The **Favorites** page allows you add help pages to a custom list. This allows you to quickly find favorite help topics that you reference frequently.

Obtaining Information about Dialogs and Property Manager Options

To obtain information about options in the **Property Manager**, click in the **Property Manager** area and press the F1 key on the keyboard. To obtain information about dialogs, click the button or click the*Help*button for information about the function of a command in an open dialog.

Internet Help Resources

There are several Internet help resources.

- Click the **File | Feedback** commands to send a problem report, suggestion, or information request by email.
- Search our website at www.goldensoftware.com or click the **File | Online** commands to update your copy of **Grapher** and for links to the Golden Software Home Page, Frequently Asked Questions, and Knowledge Base.
- The Golden Software website has a variety of resources including

training videos, a blog, a user image gallery, and a variety of links and downloads.

- The **Grapher** help can be viewed in a browser window by navigating to grapherhelp.goldensoftware.com.

Navigating the Web Help

The web help includes three layouts: desktop, tablet, and mobile. The layout automatically changes based on the screen resolution of the device you are using or the size of the browser window. Screen resolutions or browser windows less than approximately 960 pixels wide will display the mobile layout. Screen resolutions or browser windows less than approximately 1280 pixels wide will display the help in the tablet layout.

Desktop Layout

The web help is made up of three sections: the header and toolbar, the navigation pane, and the topic pane. The header and toolbar contain various commands and links. The navigation pane contains the Table of Contents and Index. The topic pane displays the information from the current help topic.

- Click the Golden Software logo in the header to navigate to the Golden Software home page: www.goldensoftware.com
- Click the button to print the contents from the topic pane. The header, toolbar, and navigation pane are excluded from the printed output.
- Click the **Grapher**logo to navigate to the Grapher Help start topic: Introduction to Grapher.
- Click *Hide* to hide the navigation pane and increase the topic pane area. Click *Show* to display the navigation pane.
- Use the *Search* field to locate a topic by keyword or title.
- Click **Contents** to view the Table of Contents in the navigation pane.
- Click **Index** to view the Index in the navigation pane. You can filter the Index by typing words or characters into the *Filter Keywords* field.

Tablet Layout

The tablet layout also includes a header and topic pane. The navigation pane and search function is replaced by a toolbar on the right or bottom of the window depending on the tablet orientation.

- Click the Golden Software logo in the header to navigate to the Golden Software home page: www.goldensoftware.com
- Click the button to print the contents from the topic pane. The

header, toolbar, and navigation pane are excluded from the printed output.

- Click the **Grapher**logo to navigate to the Grapher Help start topic: Introduction to Grapher.
- Click to open the Table of Contents.
- Click to open the Index.
- Click to open the Search.

Mobile Layout

The mobile layout contains only the topic pane and a toolbar at the bottom of the window.

- Click to open the Table of Contents.
- Click to open the Index.
- Click to open the Search.

What’s New in Grapher

Discover the new features in **Grapher** that make the product easier to use. New features are also listed on the Golden Software website.

Complete the Grapher Tutorial

The tutorial is a great way to get started in **Grapher**. The tutorial is designed to introduce you to some of **Grapher's** basic features. After you have completed the tutorial, you should be able to begin creating your own graphs. The lessons should be completed in order; however, they do not need to be completed in one session.

Automation Help

The *Grapher Automation* help book in the table of contents is designed to help you work with **Scripter**. Each object, method, and property has a help topic in **Grapher**. Use the object hierarchy to determine how to access each object. Also, each method and property contains some sample code lines with the command. To find out how a particular method or property is accessed click the object name in the *Used by* list. In some cases, you may need to change some words to work with the particular object if the sample was not specifically written for the object. Several example scripts are located in the help file and in **Grapher's** SAMPLES folder.

A Note About the Documentation

The Grapher documentation includes the online help and the quick start guide. Use the **Home | Help | Contents** command in the program to access the detailed help. Information about each command and feature in **Grapher** is included in the help. In the event the information cannot be located in the help, other sources of **Grapher** help include our frequently asked questions, knowledge base, and contacting our technical support agents.

Various font styles are used throughout the **Grapher** documentation. **Bold** text indicates menu commands, dialog names, and page names. *Italic* text indicates items properties in the **Property Manager** or items within a dialog such as group names, options, and field names. For example, the **Save As** dialog contains a *Save as type* list. Bold and italic text occasionally may be used for emphasis.

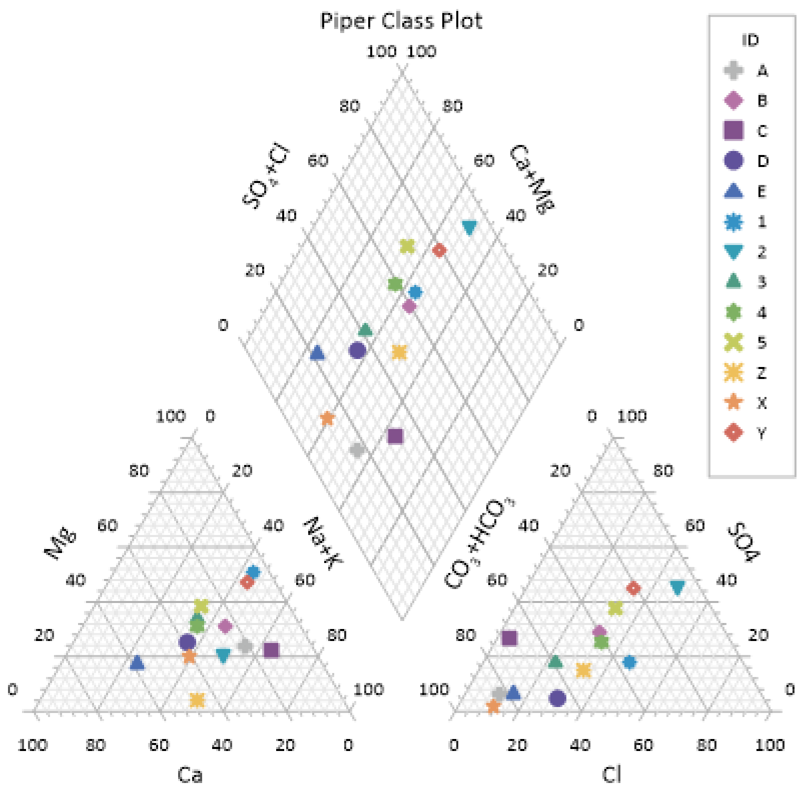
In addition, commands appear as **Home | Clipboard | Copy**. This means, "click or scroll to the **Home** tab at the top of the document, then click the **Copy** command in the **Clipboard** group." The first word is always the ribbon tab name, followed by the group name(s), and the last word is always the specific command.

Three-Minute Tour

We have included several sample files with **Grapher** so that you can quickly see some of **Grapher's** capabilities. Only a few example files are discussed here, and these examples do not include all of **Grapher's** many plot types and features. The **Object Manager** is a good source of information as to what is included in each file.

To view the sample files:

1. Open **Grapher**.
2. Select *Sample Files* in the *Files* list of the Welcome to Grapher dialog.
3. Select a sample file from the *Sample Files* list.
4. Click the *Open* button. The sample file is now displayed. Repeat as necessary to see the files of interest.
5. Click on various parts of the graph, axes, and plots in the **Object Manager**. View the object properties in the **Property Manager**.



The piper class plot.grf *sample file provides an example piper class plot with axis and graph titles, as well as a class legend.*

Using Grapher

Graphs can be created in several ways in **Grapher**. The **Home | New Graph** commands create a graph with a single plot, and then the **Add to Graph** commands can be used to add plots and features as desired. The [Graph Wizard] quickly creates a new graph with one or more plots from a single data file. The **Graph Wizard** can also be used to add features to the graph, such as legends and titles, as well as to apply a color palette to the plots in the graph.

To progress from a data file to a finished graph:

1. Create a data file. This file can be created in **Grapher's** worksheet window or outside of **Grapher** (using an ASCII text editor or Excel, for example).
2. Click the **Home** tab to select a graph type directly. For instance, click the **Home | New Graph | Basic | Line Plot** command.
3. In the **Open Worksheet** dialog, select the data file, and click *Open.* The graph is created from the selected data file, using default graph

and plot properties.

4. Adjust the graph and plot properties using the Property Manager.

Using Scripter

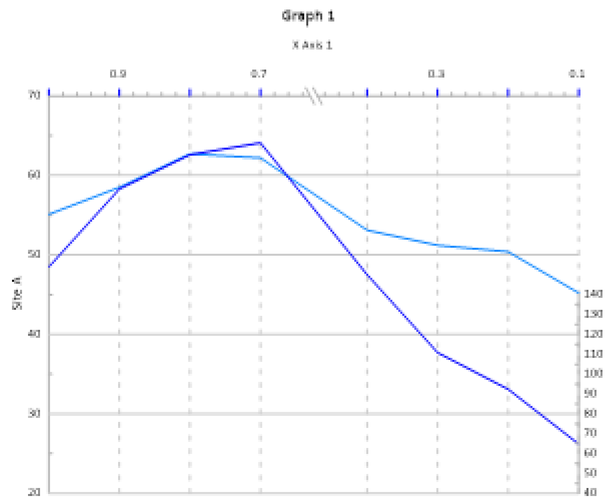
Tasks can be automated in **Grapher** using Golden Software's **Scripter** program or any ActiveX Automation-compatible client, such as Visual BASIC. A script is a text file containing a series of instructions for execution when the script is run. **Scripter** can be used to perform almost any task in **Grapher**. You can do practically anything with a script that you can do manually with the mouse or your keyboard. Scripts are useful for automating repetitive tasks and consolidating a sequence of steps. **Scripter** is installed in the same location as **Grapher**. Refer to the *Grapher Automation* help book for more information about **Scripter**. We have included several example scripts so that you can quickly see some of **Scripter's** capabilities.

Example Script Files

A variety of script files are included with **Grapher**. You can run the script as is or you can customize the script.

To run a sample script in **Grapher's**Script Manager:

1. Open **Grapher**.
2. Check the **View | Display | Script Manager**command. A check mark will indicate the manager is displayed.
3. In the **Script Manager**, click the  button.
4. In the **Open** dialog, select a sample .BAS file and click *Open*. The sample scripts folder is located at C:\Program Files\Golden Software\Grapher 13\Samples\Scripts by default. The script is displayed in the **Script Manager**.
5. Click the  button to execute the script.



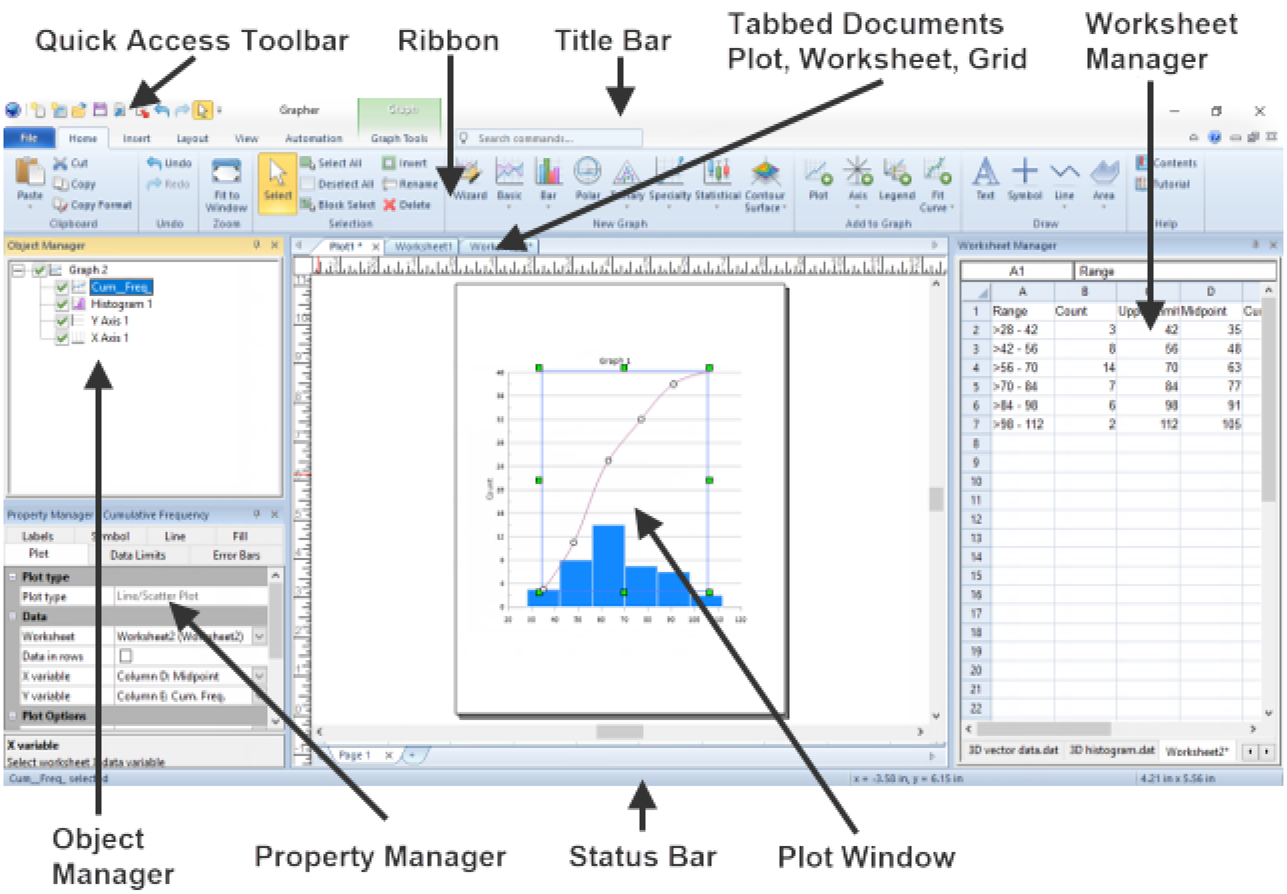
The axis properties.bas script edits all of the properties of an axis, including the tick marks, grid lines, and breaking the axis.

To run a sample script in **Scripter**:

1. Open **Scripter** by navigating to the installation folder, C:\Program Files\Golden Software\Grapher 15. Double-click on the Scripter.exe application file.
2. Click the **File | Open** command and select a sample script .BAS file from the C:\Program Files\Golden Software\Grapher 15\Samples\Scripts folder.
3. Click the **Script | Run** command to execute the script.

Grapher User Interface

Grapher contains four document window types: the plot window, worksheet window, grid window, and Excel worksheet window. Graphs and maps are displayed and edited in the plot window. Tabular data files are displayed, edited, transformed, and saved in the worksheet window. A native Excel workbook can be opened in the Excel window. Grid files can be viewed in the grid window. The **Grapher** user interface consists of the quick access toolbar, ribbon tabs and commands, tabbed documents, managers, and a status bar.



*The **Grapher** user interface includes several managers and windows with a command ribbon at the top.*

The following table summarizes the function of each component of the **Grapher** layout.

Component Name	Component Function
[Ribbon]()	The ribbon contains the commands used to run **Grapher**. Some commands are unique to the [plot document](), [worksheet document](), and [grid document]().
[Tabbed Windows]()	Multiple plot windows, worksheet windows, Excel worksheet windows and grid windows can be displayed as tabs. Click on a tab to display the window.
[Plot Window]()	The plot window contains the graphs and other graphics in one or more pages.
[Worksheet]()	The worksheet window displays the contents of the

Window	plot data sources and data files.
Status Bar	The status bar shows information about the activity in **Grapher**. The status bar is divided into three sections that contain information about the selected command or object position, the cursor position, and the size of the selected object.
Object Manager	The **Object Manager** contains a hierarchical list of objects in a **Grapher** plot window; these objects can be selected, arranged, and renamed in the **Object Manager**. The **Object Manager**is initially docked on the left side above the**Property Manager**.
Property Manager	The **Property Manager** lists the properties of a selected object. Multiple objects can be edited at the same time by selecting all of the objects and changing the shared properties. The **Property Manager** is initially docked on the left side below the **Object Manager**.
Script Manager	The **Script Manager** controls scripts that are recorded and run within **Grapher**. Right-click in the **Script Manager**to see relevant menu commands for opening, saving, and running scripts. The **Script Manager** is hidden by default.
Worksheet Manager	The **Worksheet Manager** contains a view of all data loaded into **Grapher**. Edits made in the **Worksheet Manager** are automatically reflected in the graph. Right-click in the **Worksheet Manager** to save, edit, transform, sort, or obtain statistics on cells. When plots are first created or when they are opened from a GRF file, the data file contents is displayed in the **Worksheet Manager**. When a GPJ file is opened, the embedded data is displayed in the **Worksheet Manager**.

Opening Windows

Selecting the File | Open command opens any of the three window types, depending on the type of file selected. The File | Open Excel command opens an Excel file in a native Excel window inside **Grapher**, if possible. The File | New | Plot command creates a new plot window. The File | New | Plot from Template command opens a new plot window, based on an existing template file. The File | New | Worksheet command creates a new worksheet window. The File | New | Template command creates a new plot window to use as a template file. The File | New | Excel Window opens a native Excel window inside **Grapher**, if possible.

Object Manager

When **Grapher** opens, the Object Manager is visible in the plot window by default. It contains a hierarchical list of the objects in the **Grapher** plot window. The **Object Manager** is initially docked at the left side of the window, giving the window a split appearance; however, it can be dragged and placed anywhere on the screen. The **Object Manager** can also be hidden as a tab, or displayed as a floating dialog.

Ribbon Tabs and Commands

All window types in **Grapher** include the ribbon that contains all **Grapher** commands. The ribbon is initially displayed in full size, but can be minimized by right-clicking on the ribbon and selecting **Minimize the Ribbon**. Then only ribbon tab names are displayed until the ribbon is clicked.

To customize the ribbon, right-click on the ribbon and select **Customize the Ribbon**. Select any command and click *Add* to add it to the selected ribbon tab on the left side of the dialog. Commands can only be edited in custom groups or on custom tabs.

Quick Access Toolbar

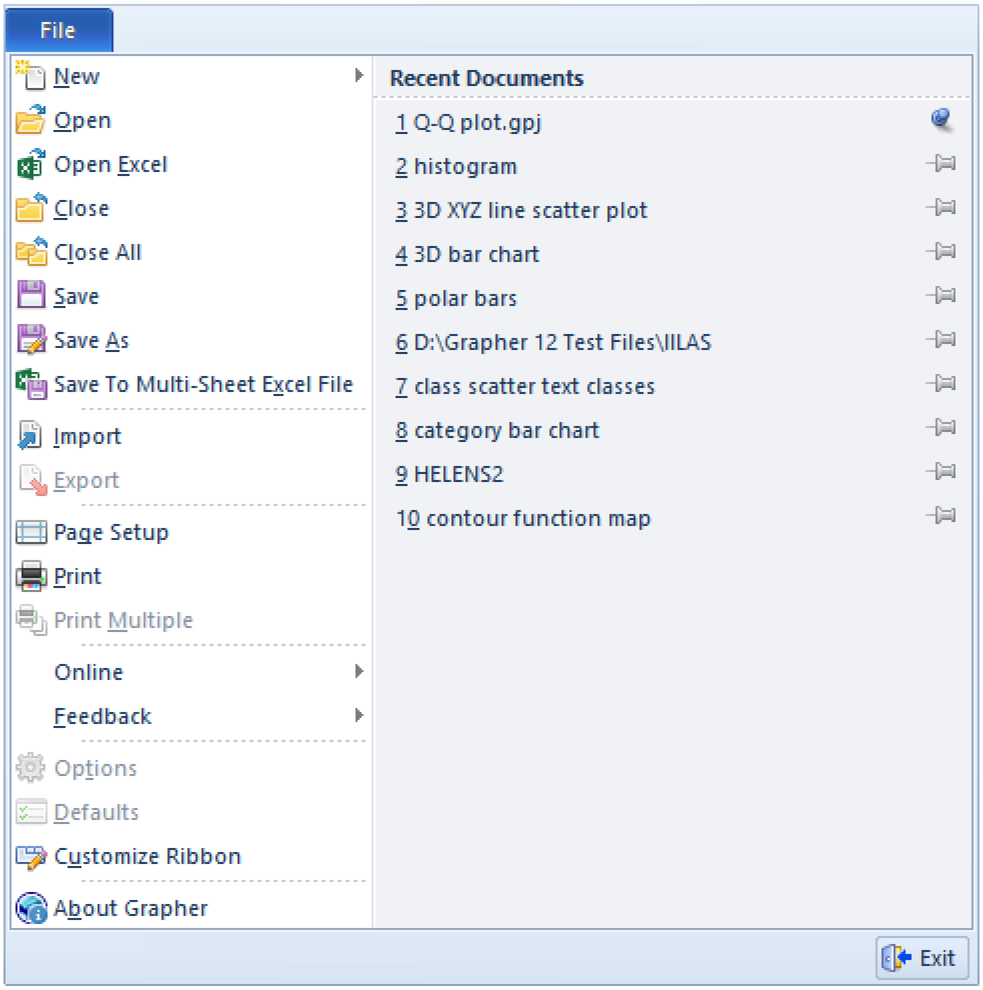
The Quick Access Toolbar is the toolbar at the top of the screen. This toolbar can be customized to include any commands. To customize the Quick Access Toolbar, right-click on the ribbon and select **Customize Quick Access Toolbar**. Select any command and drag it to the desired place on the Quick Access Toolbar.

Tab View

The plot, worksheet, and grid windows are displayed as tabbed documents. When more than one window is open, tabs appear at the top of the document, allowing you to click on a tab to switch to a different window. The tabs may be dragged to reorder them. When a document contains unsaved changes, an asterisk (*) appears next to its tabbed name. The asterisk is removed once the changes have been saved. Click the X on the tab to close that tab. If unsaved changes are in the document, a prompt to save the document appears.

Recent Documents

Use the numbers and file names listed on the right side of the **File** menu to open the most recently used files. You can type a number that corresponds with the document or click on the document name to open it.



Click on any of the document names listed in the Recent Documents*list to open that file.*

To increase or decrease the number of files displayed in the list, change the number click on the **File | Options** command. On the General page, change the *Recent files (restart required)* option. The file list maximum is 16. The default is 10.

You can pin documents to the *Recent Documents* list. Pinned files will be moved to the top of the *Recent Documents* list and will not be removed as new files are added to the list.

To pin a file, click the gray pin to the right of the file name. The pin is displayed as, and the file is pinned to the top of the *Recent Documents* list.

To unpin a file from the *Recent Documents* list, click the blue pin to the right of the file name. The pin is displayed as , and the file is unpinned.

Plot Window

A plot window is the area used for creating and modifying graphs. When you first open **Grapher**, you can choose to start from an empty plot window. Multiple plot windows can be open at one time. Click the document tabs to easily move between multiple plot windows.

Plot Document Pages

A plot document can have multiple pages. By default a plot document is created with a single page. Add pages to the plot document by clicking the + button next to the page tabs. Pages are displayed as tabs at the bottom of the plot window. Remove pages from the plot document by clicking the *X* on the tab. Double-click the tab name, type a new name, and press ENTER to rename the page.

The page tabs are displayed at the bottom of the plot document.

Click the tab to activate the page. The active page is displayed in the plot window. Only the active page is printed or exported. When saving to a Grapher 13 or earlier file format, only the active page is saved.

Plot Document Commands

File	Opens, closes, saves, and prints files. Provides links to online references and email templates. Controls options and default settings. Provides access to licensing information and **Grapher** version number.
Home	Contains the commands for creating graphs as well as some of the most commonly used commands.
Insert	Contains the commands for adding and editing drawn objects, OLE objects, images, and inset zoom objects.
Layout	Contains the commands for editing the page layout and printing options as well as the arrangement of the objects on the page.
View	Controls zoom, redraw, the window layout, and the display of managers, status bar, tabbed documents, rulers, and drawing grid.

Automation	Contains links to record or run a script and open the automation or BASIC language help files.
Graph Tools	Contains commands to modify and add items to graphs and plots.

The Application/Document Control menu commands control the size and position of the application window or the document window.

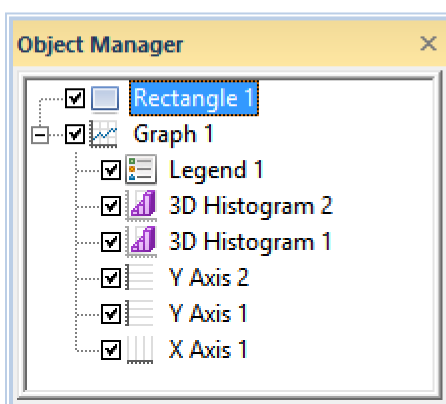
Tab View

The plot, worksheet, and grid windows are displayed as tabbed documents. When more than one window is open, tabs appear at the top of the document, allowing you to click on a tab to switch to a different window. The tabs may be dragged to reorder them. When a document contains unsaved changes, an asterisk (*) appears next to its tabbed name. The asterisk is removed once the changes have been saved.

Object Manager

The **Object Manager** contains a hierarchical list of the objects in a **Grapher** plot window. The objects can be selected, arranged, and renamed in the **Object Manager** or with ribbon commands. Changes made in the **Object Manager** are reflected in the plot window, and vice versa.

Check the **View | Display | Object Manager** command to show or uncheck the command to hide the **Object Manager**. A check mark indicates the manager is visible. No check mark indicates the manager is hidden. You can also show or access the **Object Manager** by pressing ALT+F11.



*The **Object Manager** contains a list of all objects in a* *can be used to select objects, arrange objects, and control object visibility.*

Object Visibility

Each item in the **Object Manager** list consists of an icon indicating the object type, a text label for the object, and a visibility check box. A check mark ☑ indicates that the object is visible. An empty box ☐ indicates that the object is not visible. Click the check box to change the visibility of the item. Invisible objects do not appear in the plot window or on printed output.

To change the visibility for multiple selected objects, right-click in the **Object Manager** and click **Toggle Visibility**. Visible selected objects will be hidden, and hidden selected objects will become visible.

Object Manager Tree

If an object contains sub-objects, a ⊞ or ⊟ displays to the left of the object name. Click the ⊞ or ⊟ icon to expand or collapse the list. For example, a graph object contains a plot, e.g., line/scatter, plus at least two axes. To expand the tree, click on the ⊞ icon, select the item and press the plus key (+) on the numeric keypad, or press the right arrow key on your keyboard. To collapse a branch of the tree, click on the ⊟ icon, select the item and press the minus key (-) on the numeric keypad, or press the left arrow key.

Selecting Objects

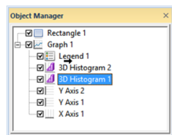
Click on the object name to select an object and display its properties in the Property Manager. The plot window updates to show the selected object with a selection bounding box and the status bar displays the name of the selected object. To select multiple objects, hold down the CTRL key and click on each object. To select multiple adjacent objects at the same level in the tree, click on the first object's name, hold down the SHIFT key, and then click on the last object's name.

Editing Object IDs

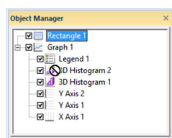
Select the object and then click again on the selected object (two slow clicks) to edit the object name. You must allow enough time between the two clicks so the action is not interpreted as a double-click. Enter the new name into the box. Alternatively, right-click on an object name and click **Rename Object**, select an object and click the Home | Selection | Rename command, or select an object and press F2. Enter a name in the **Rename Object** dialog and click OK to rename the object.

Arranging Objects

To change the display order of the objects with the mouse, select an object and drag it to a new position in the list above or below an object at the same level in the tree. The cursor changes to a black right arrow if the object can be moved to the cursor location or a red circle with a diagonal line if the object cannot be moved to the indicated location. For example, a line/scatter plot can be moved anywhere within its graph object or into another graph object, but not into a group object. Objects can also be arranged using the Layout | Move commands: **To Front**, **To Back**, **Forward**, and **Backward**.



*The cursor changes to a black horizontal arrow if an object can be moved to a new location in the **Object Manager**.*



*The cursor changes to a circle with a diagonal line if an object cannot be moved to a new location in the **Object Manager**.*

Deleting Objects

To delete an object, select the object and press the DELETE key. Some objects cannot be deleted. For example, you cannot delete an axis that is currently in use by a plot in a graph.

Keyboard Commands

Press ALT+F11 to access the **Object Manager**. Pressing ALT+F11 will also show the **Object Manager** if it is hidden or pinned.

Use the UP ARROW and DOWN ARROW keys to navigate between objects in the **Object Manager**. Hold CTRL to select multiple contiguous objects. Press LEFT ARROW or RIGHT ARROW to collapse or expand an item in the **Object Manager** such as a graph or group.

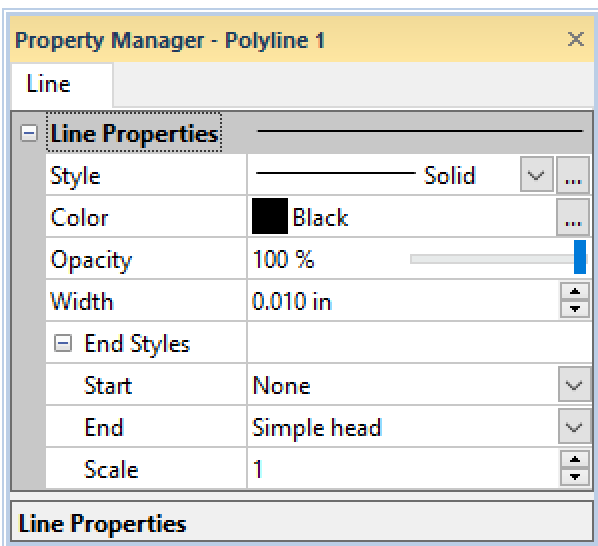
Press ALT+ENTER to access the Property Manager for the selected item. If the selected item cannot be collapsed, such as a plot or axis, you can also press ENTER to access the object's properties. If the selected item can be collapsed, such as a group or graph, press ENTER to collapse or expand the item.

Property Manager

The **Property Manager** allows you to edit the properties of an object, such as a plot or axis. The **Property Manager** contains a list of all properties for a selected object. The **Property Manager** can be left open so that the properties of selected objects are always visible.

When the **Property Manager** is hidden or closed, double-clicking on an object in the [Object Manager](), or pressing ALT+ENTER, opens the **Property Manager** with the properties for the selected object displayed. To turn on the **Property Manager**, check the **View | Display | Property Manager** command.

For information on a specific feature or property that is shown in the **Property Manager**, refer to the help page for that feature. For instance, if you are interested in determining how to set the *Symbol column* for a line/scatter plot or how to change the *Foreground color* for a bar chart, refer to the specific pages for [Symbol Properties]() or [Fill Properties]().



*The **Property Manager** displays the properties associated with the selected object.*

Expand and Collapse Features

Sections with multiple properties appear with a plus ⊞ or minus ⊟ to the left of the name. To expand a section, click on the ⊞ button. To collapse a section, click on the ⊟ icon. For example, the expanded *End Styles* section contains three properties: *Start, End,* and *Scale.*

Changing Properties

The **Property Manager** displays the properties for selected objects. To change a property, click on the property's value and type a new value, scroll to a new number using the buttons, select a new value using the slider, or select a new value from the list or palette. For example, a polyline has *Style, Color, Opacity,* and *Width* propertiesand an *End Styles* sub-section with *Start, End,* and *Scale* properties. Changing the *Color* requires clicking on the current color and selecting a new color from the color palette. Changing the *Opacity* requires typing a new value or clicking on the slider bar and dragging it left or right to a new value. Changing the *Width* requires typing a new number or scrolling to a new number. Changing the *End* requires clicking on the existing style and clicking on a new style in the list.

The selections in the **Property Manager** control which properties are displayed. Properties are hidden when they do not have an effect on the object. For example when the *Gradient* is set to *None* on the Fill page, the *Colormap* and *Fill orientation* properties are hidden. When the *Gradient* is changed to *Linear*, the *Colormap* and *Fill orientation* properties are displayed, while the *Pattern*, *Foreground color*, and *Foreground opacity* properties are hidden.

You can modify more than one object at a time. For example, click on *X Axis 1* in the **Object Manager**, and then hold the CTRL key and click *Y Axis 1*. You can change the properties of each axis simultaneously in the **Property Manager**. Only shared properties may be edited when multiple objects are selected. For example, only the line properties are displayed when both a polyline and polygon are selected. You can edit multiple plots of the same type at one time. However, no properties are displayed when the selected plots are different plot types.

Applying Property Manager Changes

Object properties automatically update after you select an item from a palette, press ENTER, or click outside the property field. When using the buttons or slider, changes are displayed on the graph immediately.

Keyboard Commands

Press ALT+ENTER to access the **Property Manager**. Pressing ALT+ENTER will also show the **Property Manager** if it is hidden or pinned. When working with the **Property Manager**, the up and down arrow keys move up and down in the **Property Manager** list. The TAB key activates the highlighted property. The right arrow key expands collapsed sections, e.g., *PlotProperties,* and the left arrow collapses the section.

CTRL+A can be used to select all of the contents of a highlighted option, such as the function plot's *Y = F(X) =* equation. CTRL+C can be used to copy the selected option text. CTRL+V can be used to paste the clipboard contents into the active option.

Property Defaults

Use the File | Options command to change the default rulers and grid settings, digitize format, line, fill, symbol, and font properties. Use the File | Defaults command to set the default values for base objects, graphs, line type plots, bar type plots, 3D XYY plots, 3D XYZ plots, maps, other plots, axes, legend, wind chart legends, and class plot legends.

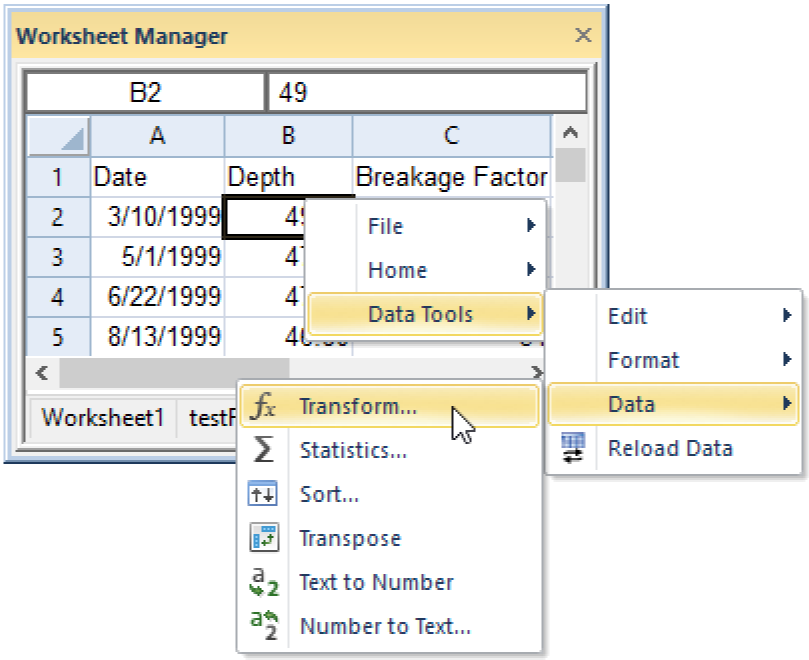
Property Manager Information Area

If the *Display Property Manager info area*is checked on the File | Options | Display page, a short help statement for each selected command in the **Property Manager**.

Worksheet Manager

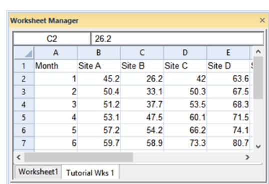
The **Worksheet Manager** contains a view of all data loaded into **Grapher**. Multiple data files are displayed in a tabbed format. By default, the **Worksheet Manager**appears at the right of the**Grapher**window.

Right-click inside the **Worksheet Manager** to open the worksheet menu commands. These commands are named similarly to the commands on the ribbon. Use the **Home | New Graph** commands to create a graph in the current plot window. Use the Data Toolsmenu commands to transform, sort, or generate statistics for the worksheet data.



Right-click in the ***Worksheet Manager*** *to access all worksheet menu commands.*

Check the **View | Display | Worksheet Manager** command to show or clear the box to hide the **Worksheet Manager**. A check mark indicates the manager is visible. No check mark indicates the manager is hidden.

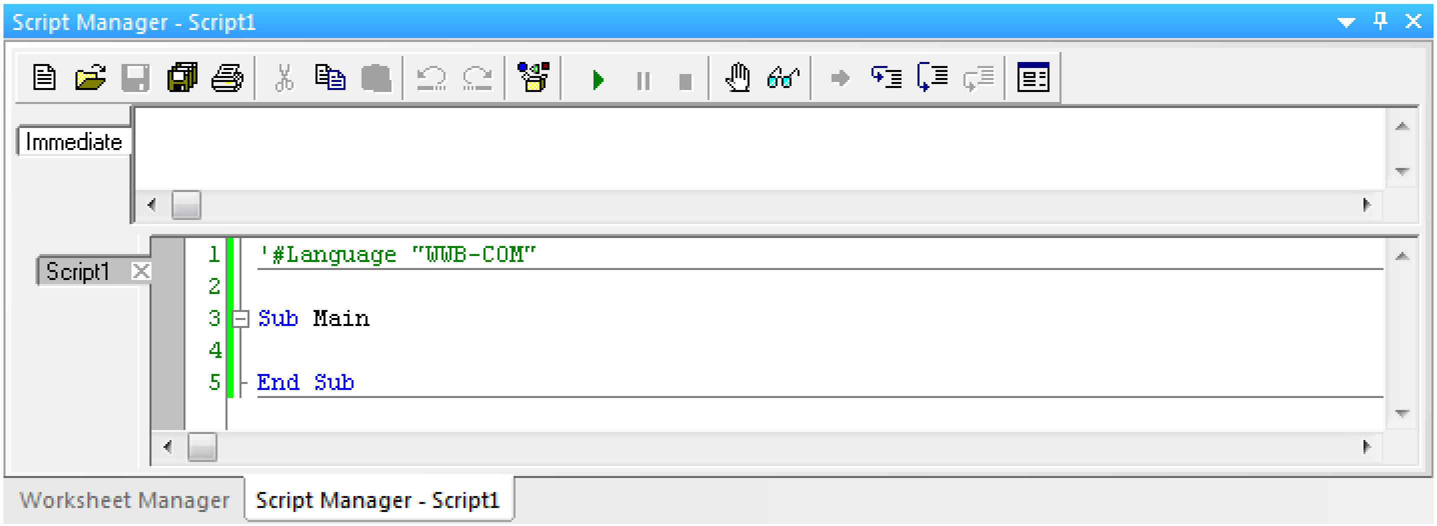


You can see all data used in all open plot windows in the ***Worksheet Manager****.*

Script Manager

The **Script Manager** allows you to work with automation within **Grapher** rather than opening Golden Software's automation program, **Scripter**, separately. All of **Scripter's** functionality is available within the **Script Manager**. Right-click in the **Script Manager** to access **Scripter**'s menu commands.

By default, the **Script Manager** is not displayed. Click the **View | Display | Script Manager** or **Automation | Script Manager | View Script Manager** command to show or hide the **Script Manager**. A check mark indicates the manager is visible. No check mark indicates the manager is hidden. When the **Script Manager** is displayed, the default location is tabbed with the**Worksheet Manager**.



*The **Script Manager** is used to view, record, edit, and run scripts.*

Script Manager Menu Commands

Right-click in the **Script Manager** window to access the following menu commands.

File	Create, open, close, save, and print scripts
Edit	Undo and redo changes; copy and paste changes; change formatting; find and replace specific text; call out various script commands; edit a UserDialog; and edit script references
View	View or hide macros, windows, toolbar, status bar, and edit buttons; view and change font and tab spacing; view or hide object and proc lists
Macro	Run, pause, or end a macro
Debug	Navigate statements; toggle and clear break points; watch and add expressions; view the selected objects methods and properties
Sheet	Open Uses statements, close statements
Help	Display help for WinWrap Basic, Basic language, and the selected word; display information about WinWrap Basic

The Application/Document Control menu commands control the size and position of the application window or the document window.

Changing the Window Layout

The managers display in a docked view by default. However, they can also be displayed as floating windows. The visibility, size, and position of each manager may also be changed.

Manager Visibility

Use the View | Display commands to show or hide the Object Manager, Property Manager, Script Manager, Worksheet Manager, and Status Bar. A check mark indicates the manager is displayed. An empty check box indicates the manager is closed. Alternatively, you can click the button in the title bar of the manager to close the manager window.

Auto-Hiding Managers

You can increase the plot document space by minimizing the managers with the *Auto Hide* feature. The manager slides to the side or bottom of the **Grapher** main window and a tab appears with the window name. To hide the manager, click the button in the upper right corner of the manager. When the manager is hidden, place the cursor directly over the tab to display the manager again. Click the button to return the manager to its docked position.

*The **Object Manager** appears as a tab on the side of the window.*

Size

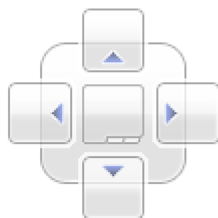
Drag the sides of a floating plot window, worksheet window, manager, toolbar, or menu bar to change its size. If a window or manager is docked, its upper and lower bounds are indicated by a or cursor. Move the cursor to change the size.

Position

To change the position of a docked manager, click the title bar and drag it to a new location. A thick light gray rectangle indicates that the manager is floating.

Docking Managers

Grapher has a docking mechanism that allows for easy docking of managers. Left-click the title bar of a manager and drag it to a new location while holding down the left mouse button. The docking mechanism displays arrow indicators as you move the manager around the screen. When the cursor touches one of the docking indicators in the docking mechanism, a blue rectangle shows the window docking position. Release the left mouse button to allow the manager to be docked in the specified location. Double-click the title bar of a manager to switch between the docked and floating positions.



The docking mechanism makes it easy to position managers.

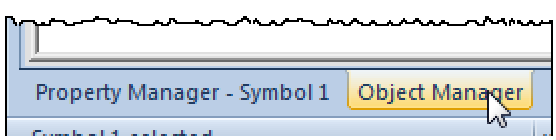
Tabbed Managers

To create tabbed managers:

1. Left-click the title bar of the manager and drag over the other manager. A docking mechanism will be displayed.
2. Hover the cursor over the center of the docking mechanism. The blue rectangle shows where the tabbed manager will display.
3. Release the mouse button.

To return to individual managers from the tabbed view:

1. Click on the manager's name on the tab.
2. Drag the tab to a new position.



Click on the manager's tab and drag the cursor to a new position to separate the managers.

Restoring the Managers to Their Default Locations

If the managers have moved or become invisible, or if they are in undesired locations, you can use the View | Display | Reset Windows command to move them back to their original locations. You must restart **Grapher** for the changes to take effect.

Status Bar

The status bar is located at the bottom of the window. Check or clear the **View | Display | Status Bar** command to show or hide the status bar. The status bar displays information about the current command or selected object in **Grapher**. The status bar is divided into three sections. The left section shows the selected object name. If a menu command is selected, a brief description of the command appears in the left section. The middle section shows the cursor coordinates in page units. The middle section also displays the graph's X and Y coordinates when using the **Graph Tools | Digitize** commands or when the *Display value on click* option is selected in the **Options** dialog. The right section displays the dimensions of the selected object.

In the Script Manager, the status bar contains current command progress on the left and the script line number on the right.

Worksheet Window

The worksheet window contains commands to display, edit, enter, and save data. The worksheet window has several useful and powerful editing, transformation, and statistical operations available. Several import and export options are available for opening data files from other spreadsheet programs. The **Data Tools** tab is automatically selected when you open or switch to a worksheet document.

Worksheet Commands

Some commands are not available when viewing a worksheet. For example, none of the Insert and Layout commands are available and only a few of the Home and View commands are available.

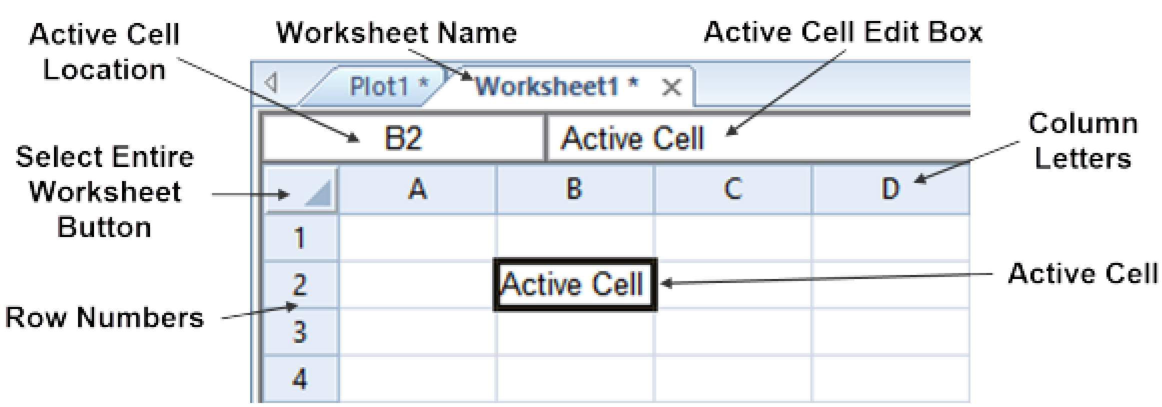
File	Opens, closes, saves, imports, exports, and prints files. Provides links to online references and email templates. Provides access to licensing information and **Grapher** version number.
Home	Contains clipboard, undo, and graph creation commands.
View	Controls the display of toolbars, managers, status bar, tabbed documents, and the window layout.
Automation	Contains links to record or run a script and open the automation or BASIC language help files.
Data Tools	Contains commands for modifying the worksheet appearance, editing the data file, and analyzing the data.

The Application/Document Control menu commands control the size and position of the application window or the document window.

Worksheet Window

To enter data in a worksheet, use the File | Open command to open an existing data file or click the File | New | Worksheet command to create a blank worksheet. Data already used to create plots can be opened in the worksheet window with the Graph Tools | Worksheet | Display command.

The components of the worksheet window are discussed below.



The components of a worksheet window shown above are described in the following table.

Column Letters	The column letters identify a column in the worksheet.
Row Numbers	The row numbers identify a row in the worksheet.
Active Cell	The active cell is highlighted with a bold outline. The active cell receives data input (numeric values or text strings) from the keyboard. Only one cell is active at a time.
Active Cell Location	The active cell location is specified by column letter and row number.
Active Cell Edit Box	The active cell edit box displays the contents of the active cell. Data typed into an empty cell appears in both the edit box and the active cell.
Worksheet Name	The worksheet name displays the data file name or the worksheet number if the data file has not been saved.
Select Entire Worksheet Button	The select entire worksheet button is used to select all cells in the worksheet.

Grid Document

The grid window contains the commands for viewing the XYZ value of grid nodes and displaying contour lines. Each grid node is indicated with a "+" in the grid window by default. The active node is highlighted with a red diamond. To move between grid nodes, press the arrow keys, or left-click a node to make it the active node. The **Grid** tab is automatically selected when you open or switch to a grid document.

Some commands are not available when viewing a grid file. For example, none of the Insert and Layout commands are available and only a few of the Home and View commands are available.

Grid Document Commands

File	Opens, closes, saves, imports, exports, and prints files. Provides links to online references and email templates. Provides access to licensing information and **Grapher** version number.
Home	Contains commands for creating graphs and links to the tutorial and help file.
View	Controls the display of toolbars, managers, status bar, tabbed documents; and the resetting of the window layout.

Automation	Contains links to record or run a script and open the automation or BASIC language help files.
Grid Tools	Controls the display of the grid window and contour levels and displays grid information

The Application/Document Control menu commands control the size and position of the application window or the document window.

Show Contours

Check the **Grid | Display | Contours** command in the Grid Document to turn on the display of contour lines on the map. When the command is checked, the contours are displayed on the map. When the command is not checked, the contours are not displayed on the map. Click on the command to toggle between showing and hiding contours.

Show Nodes

Check the **Grid Tools | Display | Nodes** command in the Grid Document to turn on the display of grid node markers on the map. When the command is checked, a "+" appears at the location of each grid node. When the command is not checked, the "+" signs are not shown. Some node markers are not displayed if the zoom or density is such that they are too close. Although not all of the markers are shown, the active node indicator still "snaps" to each grid node as the arrow keys and mouse are used.

Grid Information

In the grid document, use the **Grid Tools |Options | Grid Info** command to open a dialog with **Grid Information**. The **Grid Information** can also be accessed in the plot window by selecting the grid based map and clicking on the words <Click here to display grid information> in the **Property Manager**.

The **Grid Information** displays the following information:

- Date the grid information was created
- Grid file name
- Total Nodes
- Filled Nodes
- Blanked Nodes

Grid Geometry

- X Minimum
- X Maximum
- X Spacing

- Y Minimum
- Y Maximum
- Y Spacing

Grid Statistics

- Z Minimum
- Z 25%-tile
- Z Median
- Z 75%-tile
- Z Maximum

- Z Midrange
- Z Range
- Z Interquartile Range
- Z Median Abs. Deviation

- Z Mean
- Z Trim Mean (10%)
- Z Standard Deviation
- Z Variance

- Z Coef. of Variation
- Z Coef. of Skewness

- Z Root Mean Square
- Z Mean Square

Large Grid Files

If the grid file is large, a message box appears. Click the *OK* button to create a detailed report, or click the *Cancel* button to create a shorter, less detailed report.

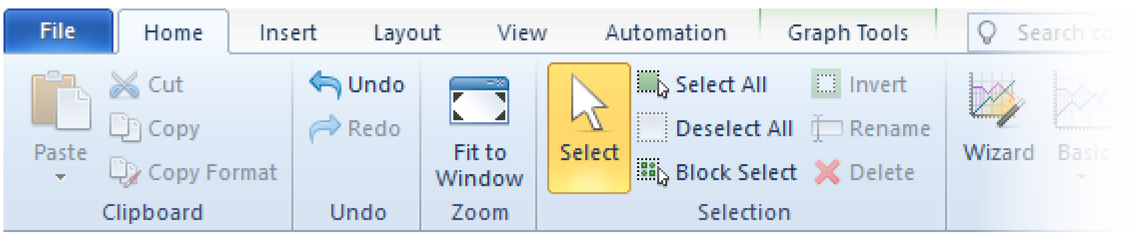
Save and Print

Use the **File | Save**command to save the grid information as a [.RTF] or [.TXT] file or use the **File | Print**command to print the grid information for reference.

Ribbon

The Ribbon is the strip of buttons and icons located above the plot, worksheet, and grid windows. The Ribbon replaces the menus and toolbars found in earlier versions of **Grapher**. The ribbon is designed to help you quickly find the commands that you need to complete a task.

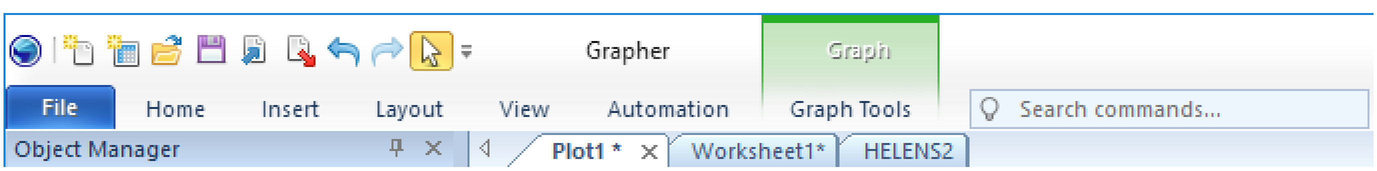
Above the Ribbon are a number of tabs, such as **Home**, **Automation**, and **Graph Tools**. Clicking or scrolling to a tab displays the options located in this section of the ribbon. The tabs have commands that are organized into a group. For instance, all the script related commands are on the **Automation**tab.



*The Ribbon is displayed with the **Home** tab selected.*

Minimizing the Ribbon

The ribbon can be minimized to take up less space on the screen. To minimize the ribbon, right-click on the ribbon and select **Minimize the Ribbon**or click the button in the top right portion of the **Grapher** window. When displayed in a minimized mode, only the tabs at the top of the screen are visible. To see the commands on each tab, click the tab name. After selecting a command, the ribbon automatically minimizes again.



The Ribbon displayed with the Minimize the Ribbon*option selected. Clicking any tab name displays the ribbon.*

Command and Help Search

The ribbon also includes a command search to the right of the last tab (**Automation**, **Graph Tools**, **Data Tools**, or **Grid Tools** depending on document type). Begin typing a command name to search for commands. Click on a command in the search results to use the command. Press ENTER to quickly use the top search result command. For example type "add" into the command search bar and the Add Plot, Add Axis, and Add Legend commands are displayed in the search results. You can also click **Search help file** at the bottom of the results list to search the help file for the search term.

The command search will return commands from all ribbon tabs. No more than five commands are displayed in the results list. A command may be disabled in the results list if the command is not applicable to the current document or selection.

Reset the Ribbon

To reset all customizations on the ribbon, click the *Reset* button at the bottom of the **Customize Ribbon** dialog.

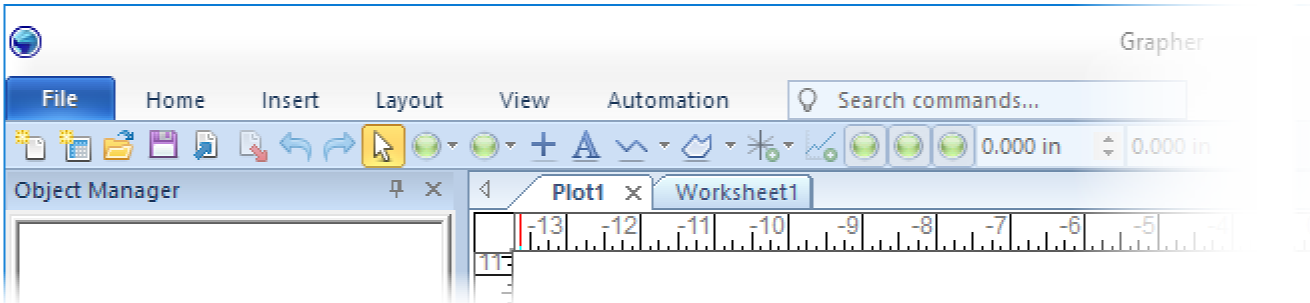
Quick Access Toolbar Commands

The Quick Access Toolbar is at the top of the **Grapher** window. This toolbar has frequently used commands and can be customized by the user. The commands in the Quick Access Toolbar are the same regardless of the type of window displayed in **Grapher**.

*The **Quick Access Toolbar** is displayed at the top of the **Grapher** window.*

Displaying the Quick Access Toolbar Below the Ribbon

To display the Quick Access Toolbar below the ribbon, right-click on the ribbon and select **Show Quick Access Toolbar Below the Ribbon**. This setting is useful if you have added many commands to the Quick Access Toolbar. More commands display, by default, when the Quick Access Toolbar is below the ribbon. When combined with the minimized ribbon appearance, this can give single click access to all your most used commands and maximize the viewing area for the plot.



Customize the Quick Access Toolbar to display all the commands you frequently use. Then, display the Quick Access Toolbar below the ribbon bar. When the ribbon bar is minimized, it appears that all of your commands are in a single toolbar, ready to create exactly what you want with a single click.

Keyboard Commands

Keyboard commands can be used to increase efficiency and precision in the **Grapher** environment.

Plot Window

You can use the keyboard to move the pointer within the plot window, to select and move objects, and perform commands.

- The ARROW keys move the pointer within the plot window when no object is selected.
- The ARROW keys move selected objects.
- Press CTRL+TAB to change switch between document windows.
- Pressing the SPACEBAR is equivalent to clicking the left mouse button.
- "Double-clicking" the SPACEBAR by pressing the spacebar twice is the same as double-clicking the mouse.
- Press SHIFT+SPACEBAR to deselect all objects.

Manager Access

- Press ALT+ENTER to activate the Property Manager
- The ARROW keys move between properties in the **Property Manager**.
- Press ALT+F11 to activate the Object Manager
- The ARROW keys move the selection in the **Object Manager**.

Tab Commands Access

The keyboard can be used to access the menu commands.

- Press the ALT key and press any letter or number that appears in a box to indicate the desired ribbon tab.
- When the appropriate tab is displayed, you can access a command by pressing the letter or number that appears in a box to indicate the desired command.
- Press ALT and the ARROW keys on the keyboard to switch between ribbon tabs.

Dialog Access

You can also use the keyboard to move around in a dialog.

- The TAB key moves between the options in the dialog. As you use the TAB key to move through the dialog, the options are highlighted as they become active.
- The SPACEBAR is used to simulate mouse clicks, allowing you to toggle check boxes or press buttons that provide you with access to other dialogs or close the current dialog.
- You can also use the underlined hotkeys by holding down the ALT key and typing the letter. This moves you immediately to the desired option. Note that not all of the dialogs have ALT key access.

General Commands

These keyboard commands are used in the plot or worksheet windows.

File

CTRL+N	Open a new plot window
CTRL+W	Open a new worksheet window
CTRL+O	Open a file
CTRL+S	Save a **Grapher** .GRF file
CTRL+I	Import a file into the plot window
CTRL+E	Export the plot window to a file
CTRL+P	Print the drawing in the current plot window or print the worksheet contents
ALT+F4	Close **Grapher**

Home

CTRL+V	Paste the clipboard contents into the plot window or worksheet
CTRL+X	Cut the selected objects to the clipboard

CTRL+C	Copy the selected objects to the clipboard
CTRL+SHIFT+C	Copy the format of the selected object
CTRL+SHIFT+V	Paste the format of the object to the newly selected objects
CTRL+Z	Undo the last command
CTRL+Y	Redo the previous undo command
F1	Open help

View

CTRL+D	Zoom so all objects fill the plot window
CTRL+L	Zoom in on selected objects so they fill the view
CTRL+G	Zoom to the extents of the page
F11	Zoom to the full screen
CTRL++	Zoom in twice the scale at the center of the screen
CTRL+-	Zoom out twice the scale from the center of the screen
CTRL+R	Zoom on a selected rectangle
F5	Redraw the screen

Arrange

CTRL+A	Select all the objects in the plot window
CTRL+SHIFT+A	Deselect all the objects in the plot window
F2	Rename the selected object
DELETE	Delete the selected objects in the plot window, clear cells in the worksheet
CTRL+PAGE DOWN	Move selected object backward
SHIFT+PAGE DOWN	Move selected object to back
CTRL+PAGE UP	Move selected object forward
SHIFT+PAGE UP	Move selected object to front

Application Control Window

CTRL+F4	Close the plot or worksheet window
ALT+F4	Close **Grapher**
ALT+SPACE	Display the application control menu
ALT+HYPHEN	Display the document window control menu
CTRL+F6	Next document window
CTRL+SHIFT+F6	Previous document window
CTRL+TAB	Switch between **Grapher** windows
ALT or F10	Activate the tabs in the ribbon
CTRL+ESC	Display the Windows start menu
ALT+TAB	Switch to the last active application

Worksheet Commands

These keyboard commands are specific to the worksheet.

F2	Edit active cell
ARROW KEYS	Move to adjacent cell
ENTER	Preserve the typed contents in the cell
HOME	Go to the first row containing data in the selected column
END	Go to the last row containing data in the selected column
PAGE UP	Scroll the table up by the number of visible rows
PAGE DOWN	Scroll the table down by the number of visible rows
TAB	Move the active cell right one column
CTRL+HOME	Move the active cell to the top cell of the left most column
CTRL+END	Move the active cell to the bottom occupied row and right most column

Customizing Commands

Click the **File | Customize Ribbon** command to customize the Quick Access Toolbar, Ribbon, and keyboard shortcuts.

Customizing the Quick Access Toolbar

The Quick Access Toolbar is a customizable toolbar. One method that can be used to add commands to the Quick Access Toolbar is to right-click on the command in the ribbon and click **Add to Quick Access Toolbar**. The command is automatically added to the end of the Quick Access Toolbar. To customize the commands and their locations on the Quick Access Toolbar, right-click the ribbon and click **Customize Quick Access Toolbar**. In the **Customize** dialog,

1. To add a command, select the command from the list on the left that you want to add. Click the *Add>>* button and the command is added to the list on the right.
2. To add a separator between commands, set the *Choose commands from* to *Home* on the left side of the dialog. Select *<Separator>* and click *Add>>*. Move the separator to the desired position.
3. To delete a command, select the command from the list on the right. Click the *<<Remove* button and the command is removed from the list on the right.
4. To rearrange commands or move separators, click on the command

or separator name from the list on the right that you want to move. Click the up and down arrow buttons on the far right to move the command up or down the list. Commands are shown in the exact order that they are displayed in the Quick Access Toolbar.

5. To reset the Quick Access Toolbar to the default display, click the *Reset* button below the list on the right side of the dialog.
6. Click OK and all changes are made.

Note: to add individual plot types to the Quick Access Toolbar, select *Home* from the *Choose commands from* list. Next, select the desired plot type, such as *3D Vertical Bar Chart*, from the commands list on the left. Click *Add>>* and the plot type is added with an icon to the list on the right. Click *OK* and the plot type is displayed in the Quick Access Toolbar.

Customizing the Ribbon

The ribbon is customizable in **Grapher**. To customize the commands in the ribbon, right-click the ribbon and select **Customize the Ribbon**. In the dialog, you can add new tabs, add groups, add commands to custom group, hide existing tabs or groups, and rearrange the tabs into an order that better fits your needs.

Tab options:

1. To add a custom tab, set the *Customize the Ribbon* section to *All Tabs*. Click in the list on the right side of the dialog where the custom tab should be located and click the *New Tab* button.
2. To delete custom tab, right-click on the tab name in the list on the right side of the dialog and select **Delete**.
3. To rename a default or custom tab, click on the tab name in the list on the right side of the dialog. Click the *Rename* button. Type the new name and press OK to make the change.
4. To hide a default or custom tab, uncheck the box next to the tab name on the right side of the dialog. Only checked tabs will be displayed.
5. To change the order of default or custom tabs, click on the tab name that should be moved in the list on the right side of the dialog. Click the up and down arrow buttons on the far right side of the dialog to move the selected tab up or down. Default tabs must remain in their major group.

Group options:

1. To add a custom group to a default or custom tab, click on the ⊞ next to the tab name. Click in the list of group names where the new group should be located and click the *New Group* button.

2. To delete a default or custom group on any tab, right-click on the group name in the list on the right side of the dialog and select **Delete**.
3. To rename a default or custom group on any tab, click on the group name in the list on the right side of the dialog. Click the *Rename* button. Type the new name and click OK to make the change.
4. To change the order of default or custom groups on any tab, click on the group name that should be moved in the list on the right side of the dialog. Click the up and down arrow buttons on the far right side of the dialog to move the selected group up or down in the list.
5. To replace a default group with a custom group, right-click on the default group name and select **Delete**. Click the *New Group* button. Add the desired commands to the new group that you want displayed. Rename the new group, if desired.

Command options:

Commands can only be added to or deleted from custom groups. Commands can only be rearranged or renamed in custom groups. If commands in default groups are desired to be edited, the default group should be deleted and a new custom group should be created with the same commands.

1. To add a command to a custom group, set the *choose commands from* list to *All Tabs* so that all commands are listed on the left side of the dialog. Select the desired command that should be added. On the right side of the dialog, click the next to the custom group name. Click on the desired position in the list of commands. If no commands exist in the group yet, click on the group name. Click the *Add>>* button and the command is added to the custom group.
2. To delete a command from a custom group, right-click on the command name in the list on the right side of the dialog and select *Delete*. Only commands from custom groups can be deleted.
3. To rename a command in a custom group, click on the command name in the list on the right side of the dialog. Click the *Rename* button. Type the new name and click OK to make the change. Only commands in custom groups can be renamed.
4. To change the order of commands in a custom group, click on the command name that should be moved in the list on the right side of the dialog. Click the up and down arrow buttons on the far right side of the dialog to move the selected command up or down in the list.

Customizing the Keyboard Shortcuts

Keyboard shortcuts can be changed by right-clicking on the ribbon and selecting **Customize the Ribbon**.

1. In the dialog, click the *Customize* button next to *Keyboard shortcuts*.
2. On the left side of the **Customize Keyboard** dialog, select the ribbon tab name in the *Categories* list where the desired command is located.
3. On the right side of the dialog, click on the command name in the *Commands* list.
4. Click in the *Press new shortcut key* box and press and hold the keys that should be used for the command. For instance, you might press and hold the CTRL, SHIFT, and H keys on the keyboard. The key names CTRL+SHIFT+H will be listed in the *Press new shortcut key* box. If no other command uses the key combination, the *Assigned to* section lists [Unassigned].
5. When the keys are unassigned, click the *Assign* button at the bottom of the dialog to assign the key combination to the selected command.

If the key combination is currently assigned to another command, the command will be listed in the *Assigned to* section. If a key combination is currently assigned to another command, select the currently assigned command name. Click on the *Current Keys* combination that you want to reassign and click the *Remove* button at the bottom of the dialog. Click back on the original command. Click in the *Press new shortcut key* box and press the keys on the keyboard. Click the *Assign* button to assign the key combination to the new command.

Click *Close* to make the new commands effective. Click *Reset All* to reset all customizations to the defaults.

Sharing Customizations Between Computers

All of the **Grapher** Quick Access Toolbar, ribbon, and keyboard commands are stored in the registry. The registry key can be copied and pasted onto other computers to easily share customizations. Be very careful when editing the registry! A small mistake can cause the program or computer to become unresponsive.

1. Make any customizations to the ribbon, quick access toolbar, and any keyboard commands you desire.
2. When all customizations have been made, close **Grapher**.
3. Open the registry. In Windows Vista and 7, you can do this by clicking the Windows Start button and typing *regedit* into the *Start Search* box.
4. Go to the *HKEY_CURRENT_USER\Software\Golden Software\Grapher\13\BCGSettings\BCGRibbonBar-59398* key.

5. Click the **File | Export** command.
6. Type a name, such as *My Customizations*, and make sure that the *Selected range* is set to the *Selected branch*.
7. Click *Save*.
8. Locate the .REG file on your computer and copy it to a CD, USB drive, or network share location.
9. On another computer, close **Grapher**.
10. Paste the .REG file in a place where it is easily found on the new computer.
11. Double-click on the .REG file.
12. Click *Yes* if you are prompted if you want to change the computer.
13. Open **Grapher**. The customizations have been applied to the new machine.

Maximize the Plot Window Display Space

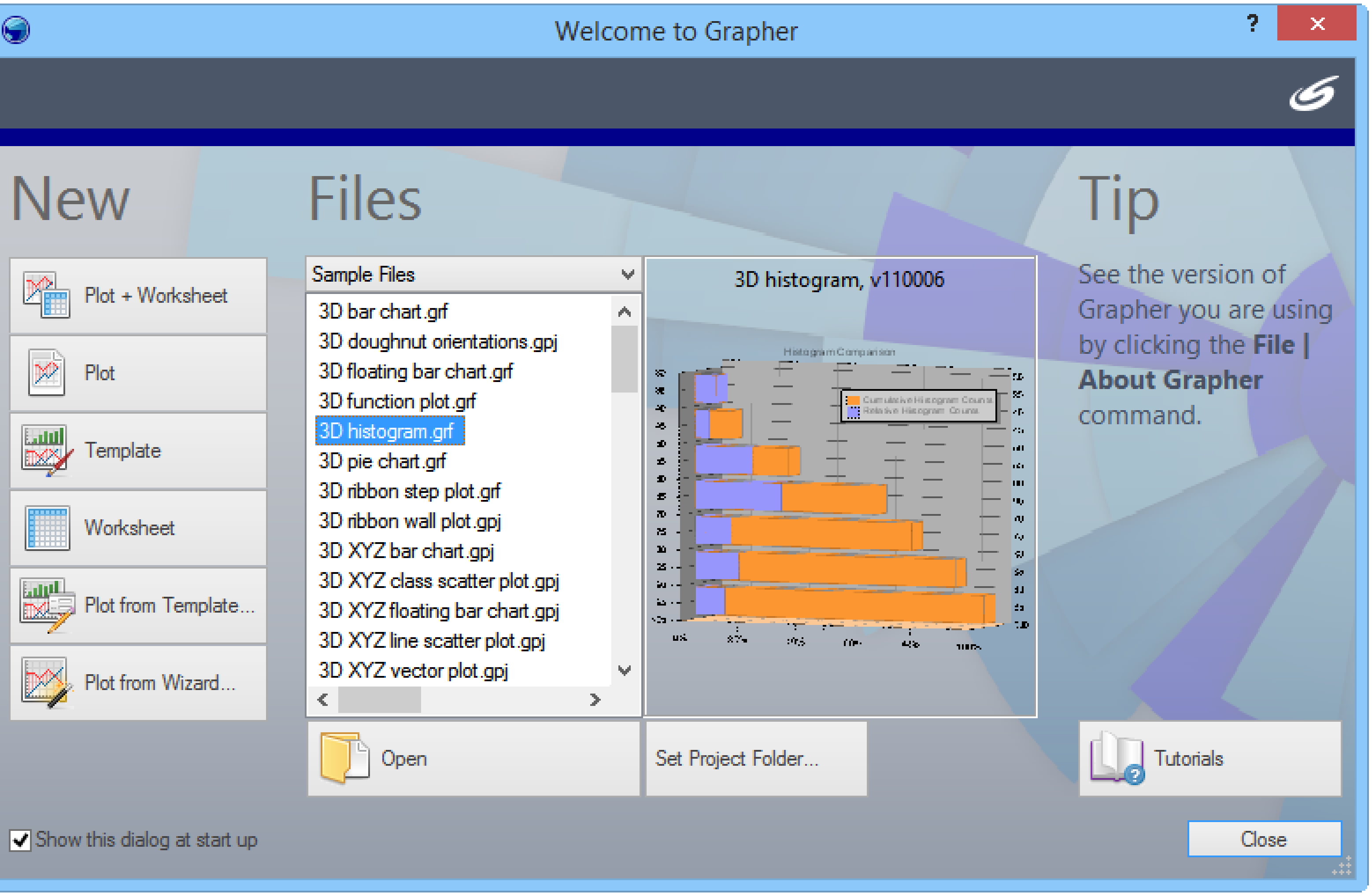
Several options exist to maximize the plot window display space. See some common options below.

One of the easiest ways of maximizing the plot window display space is to turn on only the managers that you use. To turn off other managers, click the **View** tab in the ribbon. In the **Display** section, uncheck the boxes for the managers that you do not regularly use. For instance, if you do not use the **Script Manager** or **Worksheet Manager**, unchecking these options will provide much additional space. To temporarily turn the display of all of the managers off, click the **View | Display | Hide All**command. To turn the display of all of the managers back on, click the**View | Display | Show All**command. Alternatively, check only those managers that you want to see.

The ribbon can be minimized so that the tab names appear more like menus instead of tabs. To minimize the ribbon, right-click on the ribbon and select **Minimize the Ribbon**. When displayed in a minimized mode, only the tabs at the top of the screen are visible. To see the commands on each tab, click the tab name. After selecting a command, the ribbon automatically minimizes again.

Welcome to Grapher Dialog

When **Grapher** is first opened, the **Welcometo Grapher** dialog appears. The **Welcometo Grapher** dialog provides a way to start **Grapher** in your desired method. Whatever option is selected becomes the default for all future **Grapher** sessions. The dialog reappears every time **Grapher** opens.



*The **Welcome to Grapher** dialog appears when you open **Grapher**.*

New Options

The *New* list, on the left side of the dialog, controls the default setting and the method that this instance of **Grapher** will begin with.

Click any of the buttons to open **Grapher** using the method described. For instance, click the *Plot + Worksheet* option to open **Grapher** with a new empty plot window and new empty worksheet window. Available options are *Plot + Worksheet, Plot, Template, Worksheet, Plot from Template,* and *Plot from Wizard*.

- *Plot + Worksheet* opens a new empty plot window and new empty worksheet window. This is how older versions of **Grapher** always opened. This is similar to using the **File | New | Plot** command and the **File | New | Worksheet** command or clicking the and buttons.

- *Plot* opens a new empty plot window. This is similar to using the **File | New | Plot** command or clicking the button.
- *Template* opens a new empty template window. A template can be saved and used later to create graphs with the same basic settings. This is similar to using the **File | New | Template** command.
- *Worksheet* opens a new empty worksheet window. This is similar to using the **File | New | Worksheet** command or clicking the button.
- Plot from Template creates a new empty plot window from an existing template. This is similar to using the **File | New | Plot from Template** command. After clicking the Plot from Template button, the **Open** dialog appears. Select the Grapher template GRT file and click Open. Select each data file required to open the template and click Open. The template appears with the desired data.
- *Plot from Wizard* opens a new empty plot window with the graph wizard dialog open. This is similar to using the **Graphs | Create | Graph Wizard** command. This allows an easy method to create a default graph. The wizard has settings to create every plot type.

Default Method

After clicking any of the buttons in the *New* list, the selected button is written to the **Grapher** program as an option. Every time the program is opened, this default option will be used if you click the *Close* button or the X button in the top right. In addition, this default method is used if the **Welcome to Grapher** dialog is not displayed.

To change the default method, open any plot window. Click the **File | Options** command. On the left side of the dialog, click *General*. On the right side of the dialog, change the *Start up action*. Available options match the options included as buttons in the **Welcome to Grapher** dialog. In addition, the option *Do nothing* exists from the **Options** dialog.

Files List and Preview

The *Files* list, in the middle of the dialog, contains options to open specific files. Click the current file type selection and select the desired file type from the list. Available options are *Recent Files, Sample Files, Project Files, Script Files*, and *Browse*. Select the desired option and the list updates to show all files in the selected type. Data files are not listed in this section. To open a data file, select *Browse* in the file type list.

- *Recent Files* lists the most recent 10 files that have been opened in **Grapher**. This is similar to the file list under the **File** menu. Click on any file in the list and click the *Open* button to close the **Welcome** dialog and open the selected file. The number of recent files displayed in the list can be changed in the **File | Options** dialog. Files that are pinned to the Recent Documents list will be displayed at the top of the *Recent Files* list, including pinned data files.

- *Sample Files* lists all of the GRF and GPJ files in the Grapher Samples directory. This is C:\Program Files\Golden Software\Grapher 15\Samples, by default. Click on any file in the list and click the *Open* button to close the **Welcome to Grapher** dialog and open the selected file.
- *Project Files* lists all of the GRF, GPJ, and GRT files in the selected directory. After clicking *Project Files* the first time, a **Select Folder** dialog appears. Select the directory on the computer that should be used as the *Project Files* directory and click *Select Folder*. All of the GRF, GPJ, and GRT files from the selected directory are listed. Click on any file in the list and click the *Open* button to close the **Welcome to Grapher** dialog and open the selected file. Click the *Set Project Folder* button to change the directory, or change the project folder directory in the **File | Options** dialog.
- *Script Files* lists all of the BAS files in the project folder. After clicking *Script Files* the first time, a **Select Folder** dialog appears. Select the directory on the computer that should be used as the *Project Files* directory and click *Select Folder*. All of the BAS files from the selected directory are listed. Click on any file in the list and click the *Open* button to close the **Welcome** dialog. The script is displayed in the **Script Manager** and run. Any plots or worksheets that are opened or created from the plot are created. Click the *Set Project Folder* button to change the directory, or change the project folder directory in the **File | Options** dialog.
- *Browse* opens the Open dialog, where you can select the file to open to start this instance of **Grapher**. To start **Grapher** with a file that is not in the *Recent Files* list, *Sample Files* list, or *Project Folder*, or to open a data file, select *Browse*.

Click a file name to select to file. A preview of the selected file is displayed, and the selected file can be opened by clicking the *Open* button. Click on another file or press the UP ARROW or DOWN ARROW keys to change the file selection.

Project Folder

Clicking the *SetProject Folder* button opens the **Select Folder** dialog. The **Browse for Folder** dialog will open for Windows XP users. The selected directory is used for the *Project Files* and *Script Files* file lists. The *Project Folder* can also be changed in the **File | Options** dialog. If the *Project Folder* specification is removed in the **Options** dialog, the Windows default (C:\Users\<username>\Documents) folder is used until a new project folder is selected.

Open

After clicking on a file in the file type list, click the *Open* button to open the selected file. The **Welcome to Grapher** dialog closes and the action is performed. The *Open* button is disabled until a file is selected in the *Files* list. To open a file that is not located in any of the lists, or to open a data file, select *Browse* in the file type list.

Tips

The **Welcome** dialog displays a useful tip on the right side of the dialog.

Start with the Tutorial

Click the *Tutorials* button to start **Grapher** with a new plot and worksheet and the help open to the *Tutorial Introduction* topic.

Turn Welcome Dialog Off

The *Show this dialog at start up* check box is checked by default. Click the *Show this dialog at startup* to remove the check and open **Grapher** without the **Welcome to Grapher** dialog in all future instances. After closing **Grapher** and reopening, the **Welcome to Grapher** dialog will not be displayed.

This option can be changed by clicking the **File | Options**command. In the **Options** dialog, click on *Dialog Messages* on the left side. On the right side, check the box next to *Show Welcome Dialog*. Click *OK* and the next time **Grapher** is opened, the **Welcome to Grapher** dialog is displayed.

Close

Click the *Close* button to close the **Welcome to Grapher** dialog without selecting any option. The last option selected from the *New* list is used. **Grapher** opens with that option.

File Types

Grapher primarily uses data files and **Grapher** files. Grid files can be used to create maps. Image files and vector data files can be imported into plot documents. There are three types of **Grapher** files: **Grapher** .GRF, .GPJ, and .GRT files. The type of file you create when saving your project should be determined by how you wish to link the plots and their data:

- The *Grapher File (*.grf)* file stores a link to the data file(s) used by the plots. Data files are saved separately from the GRF file. A GRF file and one or more data files are necessary to open a GRF file.
- The *Grapher Project (*.gpj)* file embeds the data for the plots in the

GPJ file. When opening a GPJ file, the plots are recreated exactly as they were saved. No outside data file is necessary to open a GPJ file.

- The *Grapher Template (*.grt)* file does not embed the data nor store links to the data. Only the plot and graph properties and layout are saved. When opening a GRT file, **Grapher** will prompt you for the data files to use for your plots.

Grapher .GRF Files

Grapher .GRF files contain all of the information necessary to reproduce the graph, except for the data. When you save a **Grapher** file, all the scaling, formatting, and parameters for the graph are preserved in the file. **Grapher** .GRF files save a link to the data and do not store the data internally in the file. For example, if a .GRF file needs to be sent to a colleague, you would need to send the data file(s) used to create the graph in addition to the .GRF file. This format is preferred for graphs where the data changes periodically and needs to link to the external source data file. When opening a GRF file, the data files are reloaded into **Grapher**. If the data files haven't changed, the plots will look the exact same as when they were saved. However, if the data files have been changed, the plots will automatically update to reflect the changes in their source data. If the data files can't be found, **Grapher** will prompt you for the data files to use for your plots.

Grapher .GPJ Project Files

Grapher .GPJ files store all of the information necessary to reproduce the graph including embedding the data. All scaling, formatting, and parameters for the graph are preserved in the file. If a .GPJ file needs to be sent to a colleague, you would only need to send the .GPJ file. This format is preferred when you want to have the data and the graph contained in a single file and the data does not change often. If the embedded worksheets contain fewer than 16,384 rows x 1,048,576 columns, then cell formatting is maintained in the GPJ.

Grapher .GRT Template Files

Grapher .GRT files are used to create a template with set graphing preferences. A saved template file does not contain a reference to a specific data file. This means that once the template graph is created, you can use the template with any data set. You can use the template to set options such as the number of decimal places on axis tick mark labels, label angles, axis labels, graph titles, line plot colors, fill colors, symbol size, or any other graphing option. If a .GRT file is sent to a colleague, they can use their own data set with the file to create a graph based on the specifications in the template file. This format is preferred when the layout of the graph needs to remain consistent with a variety of similarly formatted data files.

Data Files

In most cases, there is a prompt for a data file when you create a graph in **Grapher**. Data files can be imported from a variety of sources, such as ASCII text files, Excel files, or database files. Data can be entered directly into **Grapher's** worksheet if the files do not already exist. The data needs to be in column and row format. Data files can also be created, edited, and saved in **Grapher's** worksheet. Some of the most commonly used data types are described in the following sections.

ASCII Data

ASCII files are generic format files that can be read or produced by most applications. There are three common ASCII data formats: .DAT, .CSV, and .TXT. These files can also be imported into most applications, including word processors, spreadsheets, and ASCII editors. The files differ in the types of delimiters, or column separators, between the data. ASCII files do not contain any worksheet formatting information such as row height, column width, or cell formatting. This format does not have a limitation on the number of rows or columns.

Excel Files

Microsoft Excel .XLS, .XLSX, and .XLSM files contain data and retain some cell formatting in **Grapher**. Some information, such as formulas, is ignored. Excel files can preserve all formatting information available in the Golden Software worksheet. An Excel 2003 .XLS worksheet has a 65,536-row limit and a 256-column limit; therefore, this format cannot be used to store very large data sets. An Excel 2007 .XLSX worksheet has a 1,048,576 row limit and a 16,384 column limit.

To save all the formatting, formulas, and worksheets in an .XLS or .XLSX file, you can use Excel directly in **Grapher**. Use the File | Open Excel command to utilize all of Excel's features and create graphs in **Grapher**. Excel disables the save command, so you can only use the **Save As** command and save to a new .XLS or .XSLX file.

Use Caution when Saving Excel Files!

Use the File | Save To Multi-Sheet Excel File command to save multiple worksheets in a single Excel document.

A file can be saved in an Excel format from **Grapher** worksheet, ***but only one worksheet can be saved*** when using the File | Save or File | Save As command. If a multi-worksheet Excel file is opened and saved as an .XLS or .XLSX file from the **Grapher** worksheet, be aware that only the single worksheet is saved in the document. If the existing file is overwritten, all the unused worksheets are destroyed. In this case, a warning message is issued. The message reads: *Saving this worksheet will destroy all but one of the sheets in the existing *.xls, *.xlsx file. To overwrite the file, click OK. To choose a different file name, click Cancel.*

Database Files

In **Grapher**, graphs can be created from Access .ACCDB and .MDB files and dBase .DBF files directly without first converting to a new worksheet. A graph is created directly from the database file and will reference the database. Changes made in the database table will automatically update the graph.

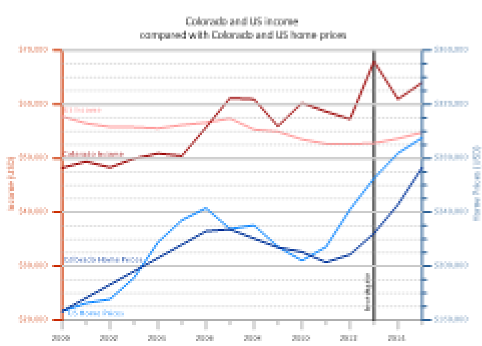
Other database formats can be imported into **Grapher**'s worksheet. Click the **File | Open** command. In the **Open** dialog, click the *Database* button. Step through the dialogs to import the file and the database is converted into a worksheet format. These files cannot be saved in their native format, but you can save the files in any of the available worksheet formats by clicking the File | Save As command.

Grid Files

Grid files are used to produce grid-based contour and surface maps in **Grapher**. Grid files contain a regularly spaced rectangular array of Z values organized in columns and rows. Grid files can be imported from a wide variety of sources. For example, the *contour grid map.GPJ* sample file uses a Surfer .GRD file to create an XY contour grid map.

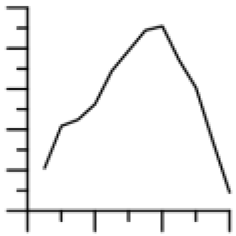
Plot Types

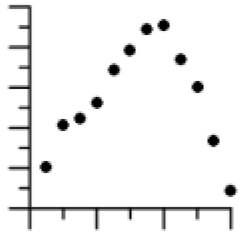
Several unique 2D and 3D plot types can be created, modified, and displayed with **Grapher**. An example of each plot type is shown below. The Home tab **New Graph** commands or the graph wizard are used to create a graph. The plot types are organized in the **Home | New Graph** groupby category:

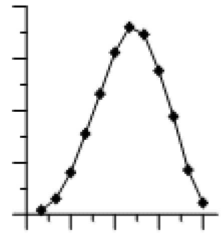


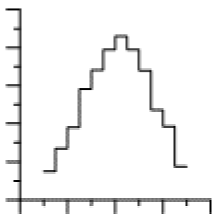
Basic Plots

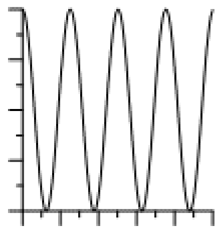
Basic plots include 2D line plots, scatter plots, line/scatter plots, step plots, function plots, bubble plots, and class plots. In most cases, two variables are displayed on two axes. The Basic plots also include 3D ribbon plots, 3D wall plots, 3D step plots, and 3D function plots. In these cases, two variables are displayed with a 3D view. Basic plots also include XYZ line/scatter plot, bubble plots, and class plots. These are true three-dimensional plots, using at least three variables and three axes.

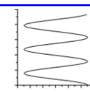

Line Plot

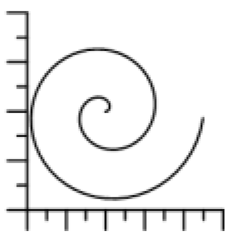

Scatter Plot

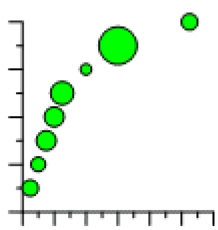

Line/Scatter Plot

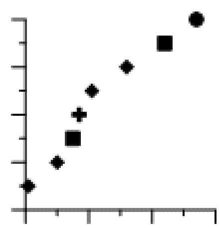

Step Plot

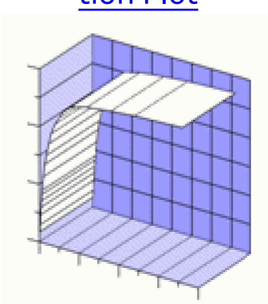

Y=F(X) Function Plot

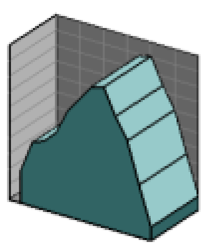

X=F(Y) Function Plot

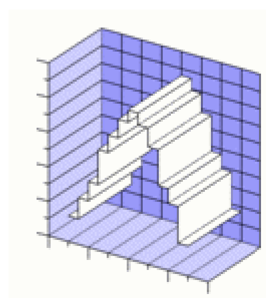

Parametric Function Plot

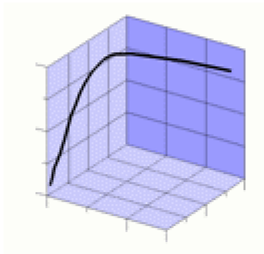

Bubble Plot


Class Scatter Plot

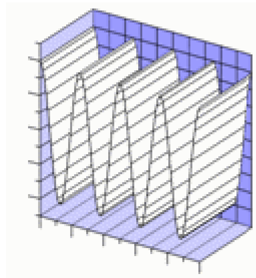

3D Ribbon Plot


3D Wall Plot

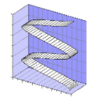

3D Step Plot



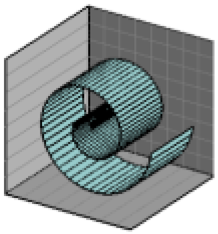
XYZ Line/Scatter Plot



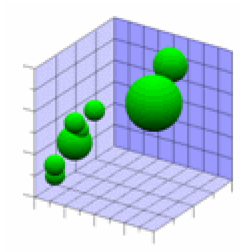
3D Y=F(X) Function Plot



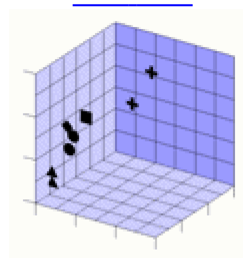
3D X=F(Y) Function Plot



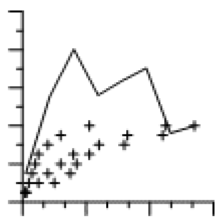
3D Parametric Function Plot



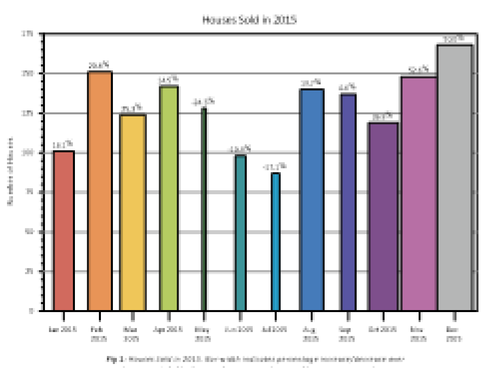
XYZ Bubble Plot



XYZ Class Scatter Plot

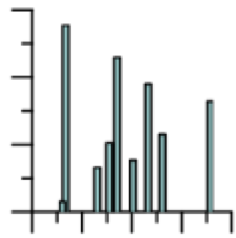


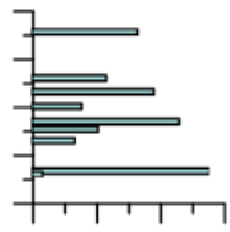
2D Summation

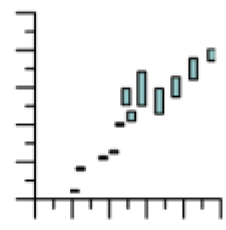


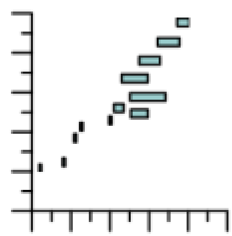
Bar Plots

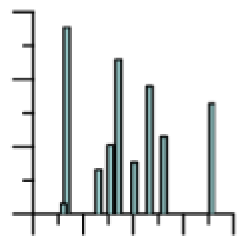
Bar plots include 2D, 3D, or XYZ horizontal and vertical bar charts and floating bar charts. For 2D bar charts, two variables are displayed on two axes. For 3D bar charts, two variables are displayed with a 3D aspect. 2D and 3D bar charts can also be created directly from category data. XYZ bar charts are true three-dimensional bar charts, where three variables are displayed on three axes.

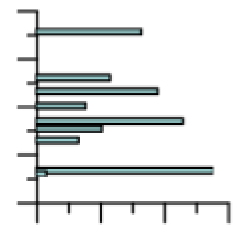

Vertical Bar Chart

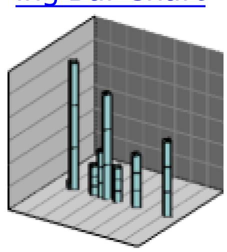

Horizontal Bar Chart

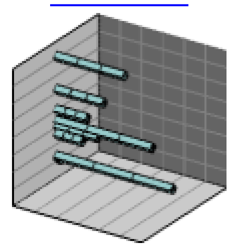

Vertical Floating Bar Chart

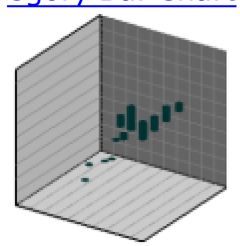

Horizontal Floating Bar Chart

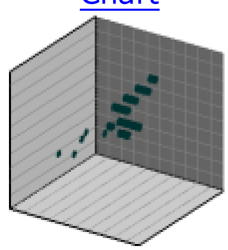

Vertical Category Bar Chart

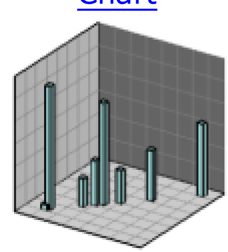

Horizontal Category Bar Chart

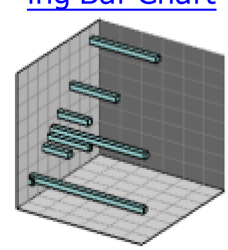

3D Vertical Bar Chart

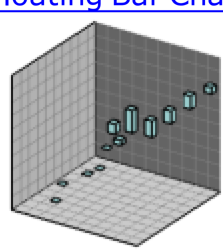

3D Horizontal Bar Chart

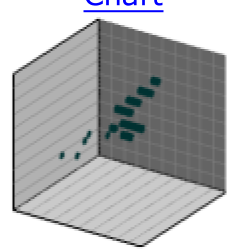

3D Vertical Floating Bar Chart

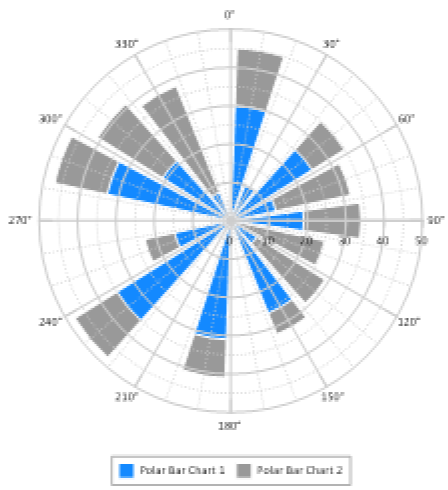

3D Horizontal Floating Bar Chart


XYZ Vertical Bar Chart


XYZ Horizontal Bar Chart

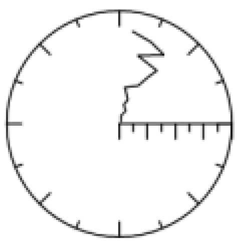

XYZ Vertical Floating Bar Chart


XYZ Horizontal Floating Bar Chart

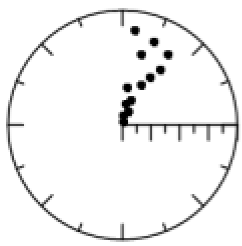


Polar Plots

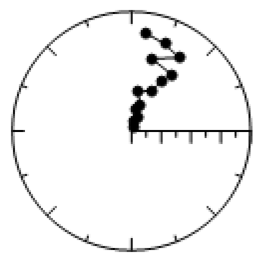
Polar plots include polar line plots, scatter plots, line/scatter plots, class plots, vector plots, function plots, bar charts, rose charts, wind charts, and radar charts. Data are positioned on a circular plot at an angle and a specified distance away from the center location. Rose charts are histograms where data are binned by angle value. Wind charts are similar to rose charts but the data in the bins is further categorized by a second variable. Radar charts represent multi-variate data on equi-angular spokes, or radii.



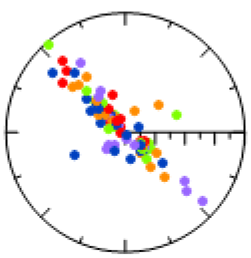
Polar Line Plot



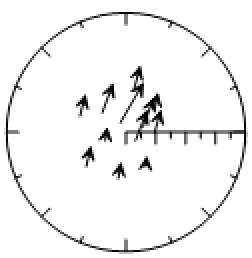
Polar Scatter Plot



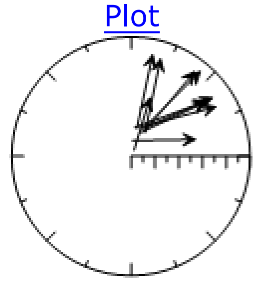
Polar Line/Scatter Plot



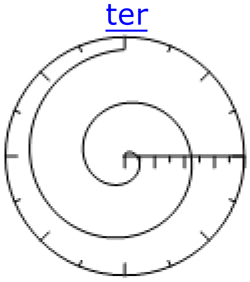
Polar Class Scatter



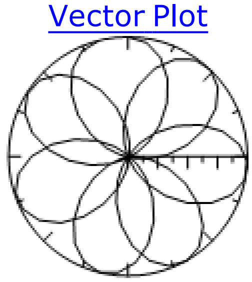
2-Point Polar Vector Plot



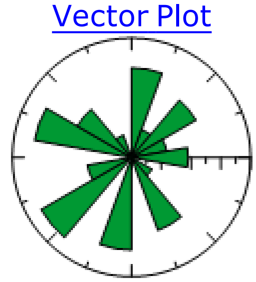
1-Point Polar Vector Plot



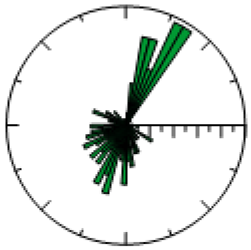
Function Plot



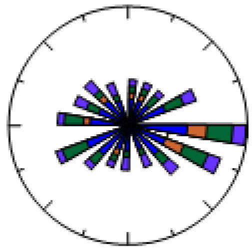
Parametric Function Plot



Polar Bar Chart

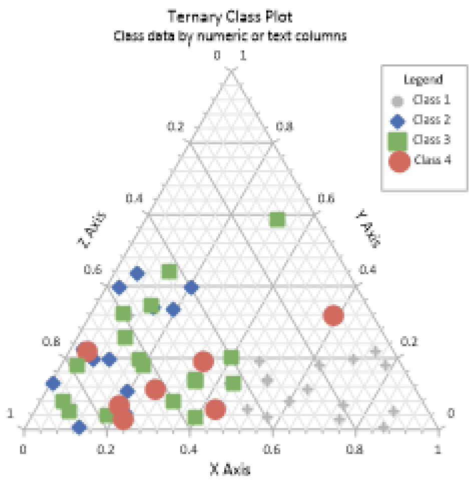


[Polar Rose Chart](#)



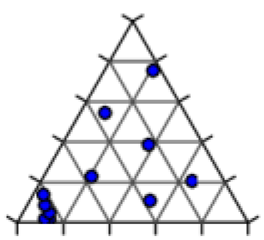
[Polar Polar Wind Chart](#)

[Radar Chart](#)

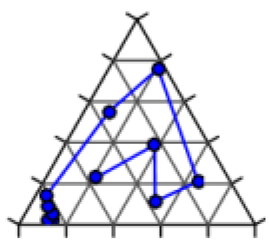


Ternary Plots

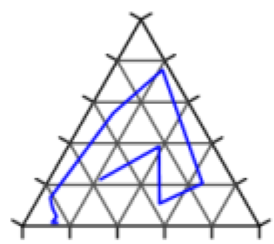
Ternary plots include ternary scatter, line/scatter, line, class, and bubble plots. The Ternary group also includes piper and piper class plots. All ternary plots display three variables on three axes, arranged in a triangle display. Classification information can be displayed on the plot when using a ternary class plot. Ternary bubble plots add a fourth dimension to the plot by varying symbol size based on another data column. Piper plots include two ternary plots, typically one cationic and one anionic. The cationic and anionic plots are projected onto a diamond plot.



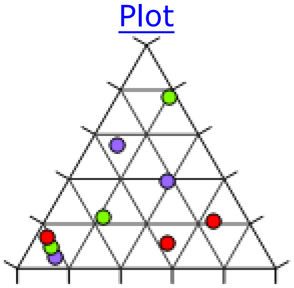
[Ternary Scatter Plot](#)



[Ternary Line/Scatter Plot](#)

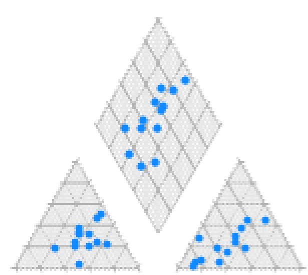


[Ternary Line Plot](#)



[Ternary Class](#)

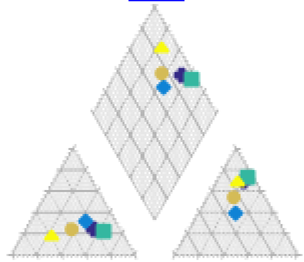
[Ternary Bubble](#)



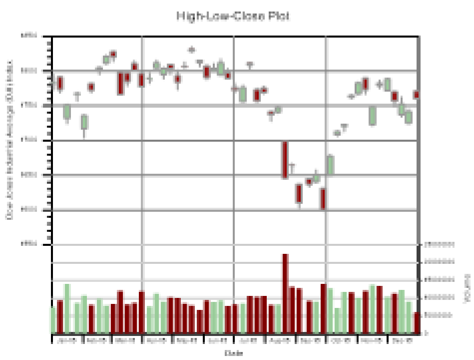
[Piper Plot](#)

Scatter Plot

Plot

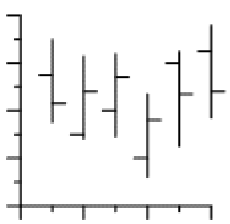


Piper Class Scatter Plot

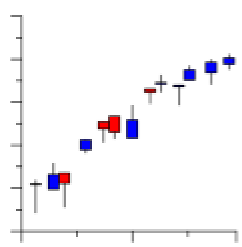


Specialty Plots

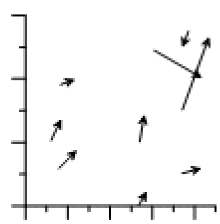
Specialty plots include high-low-close plots, candlestick plots, 2D and 3D vector plots, and stiff plots. High-low-close and candlestick plots display at least three variables on two axes. Vector plots display four or six variables on two or three axes. Vectors can be displayed between two points (XYXY and XYZ-XYZ plot types) or from a starting point to another point (XYAM and XYZ-dx, dy, dz plot types). Stiff plots show concentrations, typically anion and cation concentrations in water.



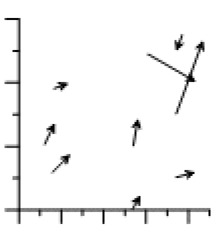
High-Low-Close Plot



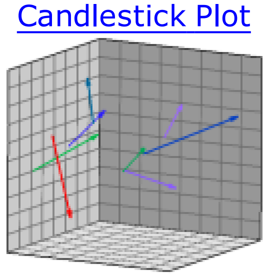
High-Low-Close Candlestick Plot



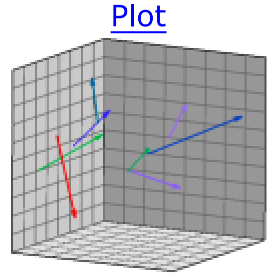
1-Point Vector Plot



2-Point Vector

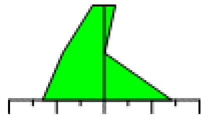


XYZ 2-Point

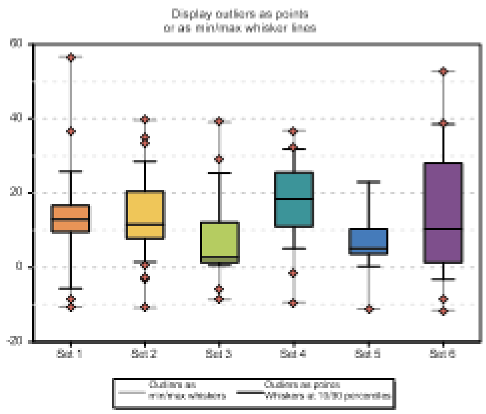


XYZ-dx,dy,dz

Plot | Vector Plot | Vector Plot

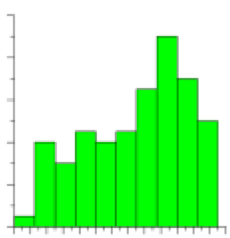


Stiff Plot

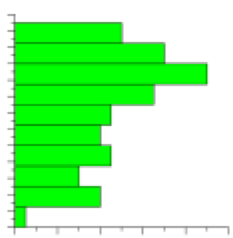


Statistical Plots

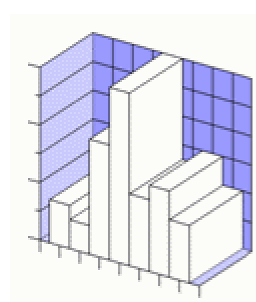
Statistical plots include 2D and 3D vertical and horizontal histograms, box-whisker plots, 2D and 3D pie charts, Q-Q plots, and 2D and 3D doughnut plots. Histograms read raw data and count the number of instances in each bin and then display the bin frequency as a bar. Pie charts display data as percentages of a whole. Doughnut plots are similar to pie charts, but can be stacked and have a hole in the center. Box-whisker plots and notched box-whisker plots display median, quartile, and outliers for a data set. Q-Q plots display a data set compared to another data set or to the normal distribution.



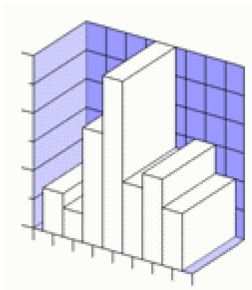
Vertical Histogram



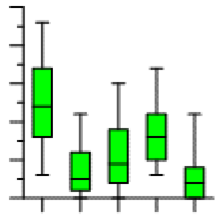
Horizontal Histogram



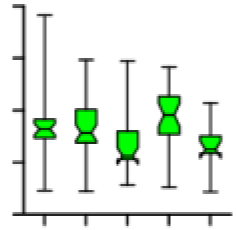
3D Vertical Histogram



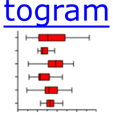
3D Horizontal Histogram



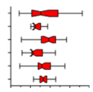
Vertical Box Plot



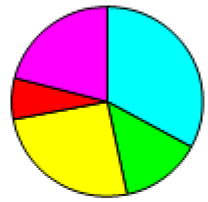
Notched Verical Box Plot



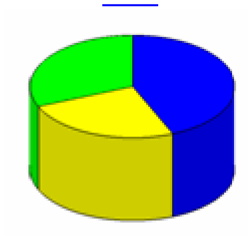
Horizontal Box Plot



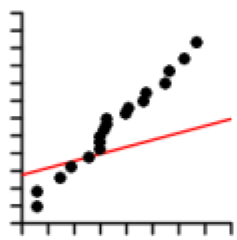
Notched Horizontal Box Plot



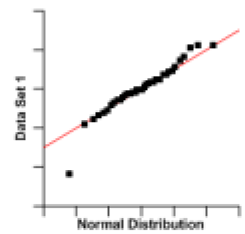
Pie Chart



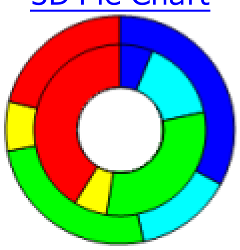
3D Pie Chart



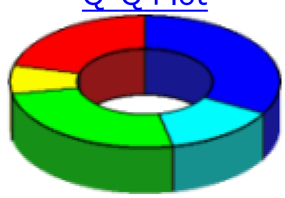
Q-Q Plot



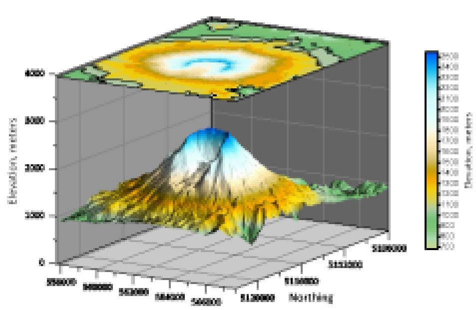
Normal Q-Q Plot



Doughnut Plot

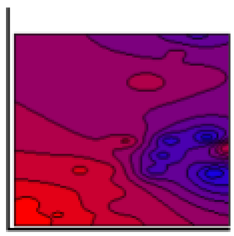


3D Doughnut Plot

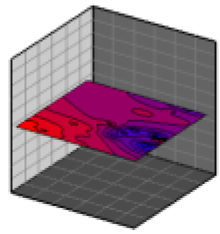


Contour Surface Maps

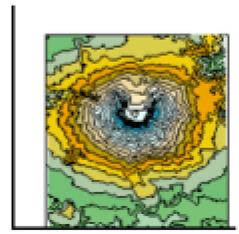
Contour maps include contour data maps, grid maps, and function maps. Contour maps are 2D representations of three variables. The contour line defines the equal Z values across the map. Contour maps can be displayed with an XY or XZ orientation. Surface Maps include surface data maps, grid maps, and function maps. Surface maps are 3D color representations of three variables.



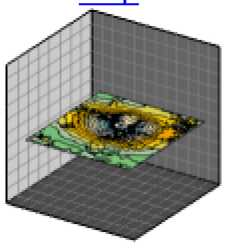
XY Contour Data Map



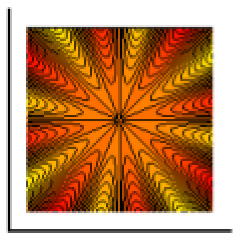
XZ Contour Data Map



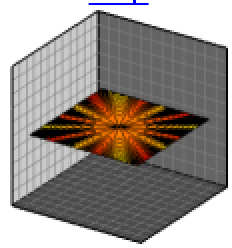
XY Contour Grid Map



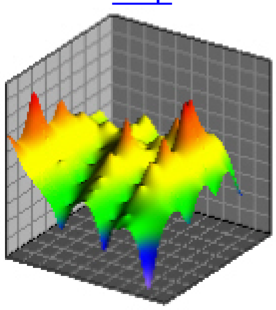
XZ Contour Grid Map



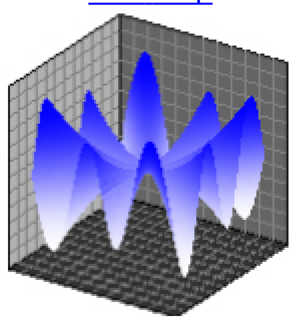
XY Contour Function Map



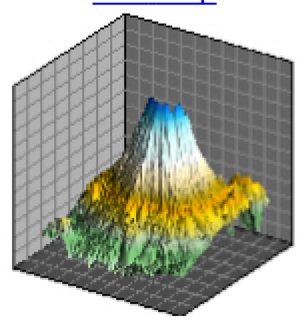
XZ Contour Function Map



Surface Data Map



Surface Function Map



Surface Grid Map

Creating Graphs

You can create graphs in several ways in **Grapher**. These methods include creating graphs with the graph wizard, from the Home tab commands, from the worksheet, and from templates.

Additional plots, axes, legends, titles, summation plots, duplicate axes, and magnifiers can be added to the graph after it is created. All properties of the plot can be edited after the graph is created.

Creating Graphs with the Graph Wizard

The Graph Wizard leads you through the necessary steps to create a new graph. This is often the fastest way to make a graph with multiple plots from a single data file. The **Graph Wizard** also makes it easy to add items such as axes, legends, and titles.

To create a graph with the graph wizard:

1. Click the **Home | New Graph | Wizard** command.
2. In the **Graph Wizard - Select Data** dialog, select the data file for the graph from the *Select File* list. A preview of the data file is displayed in the *Data Preview* section.
3. Click the *Next* button.
4. In the **Graph Wizard - Select Plot Type** dialog, choose a plot type for the new graph. Filter available *Plot types* with the *Category* list or search for plot types with the *Search* bar. See a description of the selected plot type in the *Description* section, or click *Help* to view descriptions for all plot types.
5. After selecting a plot type, define the number of plots you wish to create and their associated data columns in the *Data Columns* section.
6. Click the *Next* button.
7. In the **Graph Wizard - Properties** dialog, select which graph components you wish to display. If the graph contains multiple plots, you can select a *Color palette* for the plots as well.
8. Click the *Finish* button to create the graph.

The graph is created with the specified properties. You can change the properties of a selected graph, plot, or axis through the Property Manager.

Creating Graphs in the Plot Window

The most common method of creating graphs is to use the **Home | New Graph** commands. To create a graph in the plot window:

1. Click or scroll to the **Home** tab.
2. In the **New Graph** group, click the **Basic**, **Bar**, **Polar**, **Ternary**, **Specialty**, **Statistical**, or **Contour Surface** plot category.
3. Click on the plot type you would like to create.
4. Select a data file in the **Open Worksheet** dialog and click *Open*. If you are creating a contour grid map or surface grid map, you are prompted for a .GRD file. If you are creating any type of function plot, you are not prompted for a data or grid file.

The graph is created with the default properties. You can change the properties of a selected plot or axis through the Property Manager.

Creating Graphs from the Worksheet

If you are working with the data in the worksheet, you can create a graph without switching to the plot window. Simply select the columns you wish to plot and choose the graph type you wish to create. To create a graph from the worksheet:

1. Open the worksheet you wish to use for the plot or plots.
2. Highlight the columns to use in the plot or plots.
3. Click the **Home** tab. If you are using the **Worksheet Manager**, right-click in the worksheet and select **Home | New Graph** from the context menu.
4. In the **New Graph** group, click the **Basic**, **Bar**, **Polar**, **Ternary**, **Specialty**, **Statistical**, or **Contour Surface** button. In the **Worksheet Manager**, click the **Basic**, **Bar**, **Polar**, **Ternary**, **Specialty**, **Statistical**, or **Contour Surface** in the context menu.
5. Select the plot type you would like to create and the graph is created with the default plot properties.

When creating a graph with multiple plots, the plot colors are automatically varied. You can change the properties of a selected plot or axis through the Property Manager.

Creating Graphs Using Templates

Templates are used to set graphing preferences in **Grapher**. A template file does not contain any reference to a data file. This means that once the template graph is created, you can use the template to create a new graph with any compatible data set. To create a new plot from a template:

1. Click the **File | New | Plot from Template** command.
2. Select a .GRT template file in the **Open** dialog, and click *Open*.
3. Select the data file to use with the template. Select the *Use this worksheet for remaining items* option if all the plots in a template use the same worksheet.
4. Check the *Set columns* if you want to change the column specifications for individual plots in the graph.
5. Click the *Open* button and the new plot is created.

You can change the properties of a selected plot or axis through the Property Manager. Refer to template graphs for information on creating or saving an edited template.

Register Your Software

Please remember to register your software by filling out the registration form online. Registering your software entitles you to free technical support and signs you up for the latest Golden Software announcements. Our database is confidential. We never sell or share your data with anyone. Please take a minute to register your copy of **Grapher** with us.

To register your serial number,

1. Navigate to myaccount.goldensoftware.com.
2. Log in to your account.
3. Click *Register Software*.
4. Fill out the registration form.
5. Click *Submit Registration*.

Check for Update

Updates contain new features, improvements, and bug fixes to the program. It is recommended that you keep automatic updates turned on, so that you are always using the most recent version of the program.

Manual Update

Use the **File | Online | Check for Update** command to check for the most recent version of **Grapher**. Before using this command, make sure your computer is connected to the Internet. Follow the directions in the dialog to complete the update if an update is available. If you have difficulties with the **File | Online | Check for Update** command, please contact technical support.

When there is an available update to a new minor version (e.g. **Grapher 15.0** to **Grapher 15.1**), follow the directions to download and install the free update. An update contains minor changes to the program. Updates are available at no cost and there are not typically new features added in updates. A list of changes is located at www.goldensoftware.com/Grapher-Version-Info.

If there is an available update to a new major version (e.g. **Grapher 13** to **Grapher 15**) and your license has active maintenance, you can follow the directions to download and install the latest version. Major version updates include new features and improvements as well as bug fixes. If your maintenance is expired, you can renew your maintenance from your Golden Software My Account portal.

Automatic Update

The automatic update preference can be adjusted at any time using the File | Options command. The program periodically checks for an available update when automatic update is enabled. You will receive a message with the option to update **Grapher** when an update is available.

Check for Internet Update

- Use the **File | Online | Check for Update** command, the **Internet Update** dialog appears.
- Click the *Next* button to proceed. **Grapher** will attempt to connect to the Golden Software server and check if an update exists for your version of the product.
- If no update exists and/or you are already running the latest version, a dialog will appear letting you know there are no updates for your current version of **Grapher**. Click the *OK* button and then the **Internet Update** dialog will close.
- If an update is available, the dialog will inform you about the specifics of the update. Click the *Next* button to download the update file. A progress gauge is displayed. If you choose not to download the update at this time, click the *Cancel* button. It is highly advised that updates be installed when they are found as updates contain corrections to problems that have been found in the program.
- When the download is complete, the **Install Updates** dialog will appear.
- Save any changes to your work and exit the **Grapher** program by choosing the **File | Exit** command. Click the *Install* button to proceed with the update.
- After the update is installed successfully, you can open **Grapher** and continue working.

Technical Support

Golden Software’s technical support is free to registered users of our products. Our technical support staff is trained to help you find answers to your questions quickly and accurately. We are happy to answer any of your questions about any of our products, both before and after your purchase. We also welcome suggestions for improvements to our software and encourage you to contact us with any ideas you may have for adding new features and capabilities to our programs.

When contacting us with your question, please have the following information available:

- Your **Grapher** product key, found in the **File | License Info** dialog or in the email received with the download directions
- Your **Grapher** version number, found in File | About Grapher
- The operating system you are using (7, 8, 10 or higher)
- The steps you took prior to experiencing your problem
- The exact wording of the first error message (if any) that appeared

If you cannot find the answer to your question in the help, the frequently asked questions, or the knowledge base, please do not hesitate to contact us:

Email: GrapherSupport@GoldenSoftware.com

Web: www.GoldenSoftware.com

Phone: 303-279-1021

Fax: 303-279-0909

Mail: Golden Software, LLC, 809 14th Street, Golden, Colorado, 80401-1866, USA

Chapter 2 - Tutorial

Tutorial Introduction

The tutorial is designed to introduce you to some of **Grapher's** basic features and should about an hour to complete. After you have completed the tutorial, you will have the skills needed to begin creating your own graphs with your own data. The lessons should be completed in order; however, they do not need to be completed in one session.

Tutorial Overview

The following is an overview of lessons included in the tutorial.

- *Starting Grapher* shows you how to begin a new **Grapher** session and open a new plot window.
- *Lesson 1 - Viewing and Creating Data* opens and edits an existing data file and creates a new data file.
- *Lesson 2 - Creating a Graph* shows you one way to create a graph.
- *Lesson 3 - Editing Axes* shows you how to add an axis title, how to change the tick mark spacing, how to change the tick label source, and how to add a second linked axis.
- *Lesson 4 - Adding and Editing a Legend* shows you how to add a legend and modify the legend's appearance.
- *Lesson 5 - Working with the Script Recorder* shows you how to use the **Script Recorder** with the techniques in the previous lessons and adds a few new items. This is an optional advanced lesson. Because other features are covered in this advanced lesson, it is highly encouraged that you complete *Lesson 8*, even if you do not wish to use the script recorder.

Advanced Tutorial Lessons

The help file includes three advanced tutorial lessons. The advanced tutorial lessons demonstrate the features of the graph magnifier and inset zoom and demonstrates how move a plot to a different graph. These lessons are not included in the Quick Start Guide.

- *Using the Magnifier* shows you how to add a magnifier to your graph.

A Note About the Documentation

Various font styles are used throughout the **Grapher** quick start guide and online help. **Bold** text indicates command names, dialog names, and page names. *Italic* text indicates items within a dialog such as section or group names, options, and property names. For example, the **Save As** dialog contains a *Save as type* list. Bold and italic text occasionally may be used for emphasis.

In addition, commands appear as **Home | Clipboard | Copy**. This means, "click or scroll to the **Home** tab at the top of the document, then click the **Copy** command in the **Clipboard** group." The first word is always the ribbon tab name, followed by the group name, and the last word is always the specific command.

Starting Grapher

To begin a **Grapher** session:

1. Navigate to the installation folder, C:\Program Files\Golden Software\Grapher 15 by default.
2. Double-click on the Grapher.EXE application file.
3. Select the type of document to create in the Welcome to Grapher dialog. For the tutorial, select *New Plot*.
4. A new empty plot window opens in **Grapher**. This is the work area for producing graphs.

If this is the first time that you have opened **Grapher**, you will be prompted to license **Grapher**. Activate your Single-User product key, select a license server, or continue using the trial. Your product key is located in the download instructions email. You may also access your product key at your Golden Software My Account page.

If you have already been working with **Grapher**, open a new plot window before starting the tutorial. To open a new plot window, click the File | New | Plot command, click the button on the Quick Access Toolbar, or press CTRL+N on the keyboard.

Lesson 1 - Viewing and Editing Data

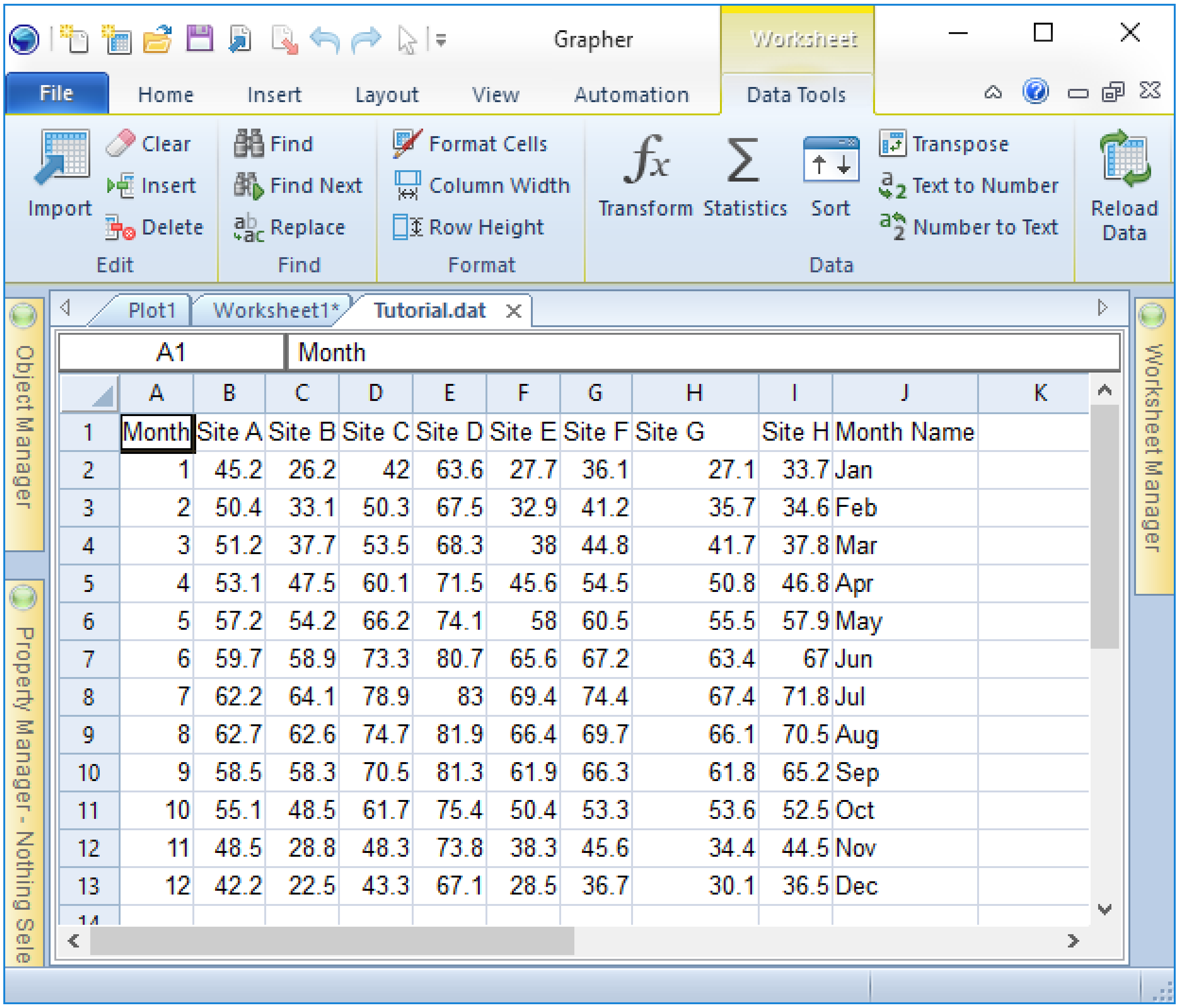
A data file is a file that contains columns or rows of data values. At minimum, two columns or rows are required to create most 2D graphs in **Grapher**. Data files can contain header information, labels, point identifiers, filter information, and data. It is often a good idea to examine the data file contents before creating your graph. The **Grapher** worksheet can be used to create a new data file. Refer to the *Worksheet Window* help topic for information about the various components of the worksheet window.

Opening an Existing Data File

If you would like to view or edit data, you can open the data file in **Grapher**. There are several ways to view a data file. If a graph has already been created, the most common method to view the data is to use the **Worksheet Manager**. If a graph is not yet created, you can open the data in the worksheet window.

1. Click the **File | Open** command, click the  button on the Quick Access Toolbar or press CTRL+O on the keyboard. The **Open** dialog displays.
2. If you are not in the Samples folder, browse to it. The Samples directory is located at C:\Program Files\Golden Software\Grapher 15\Samples by default. In the list of files, click *Tutorial.dat*.
3. Click *Open* to display the data in the worksheet window.

Notice that there are several columns of data. Column A contains Month number data. Columns B through I contain site information. Column J contains an abbreviation of month names. Row 1 contains header text, which is helpful for identifying which column contains which data. When a header row exists, the information in the header row is used in the Property Manager when selecting worksheet columns.



The data is displayed in a worksheet window. Note that each variable is a separate column. Row 1 contains a description of what the column contains.

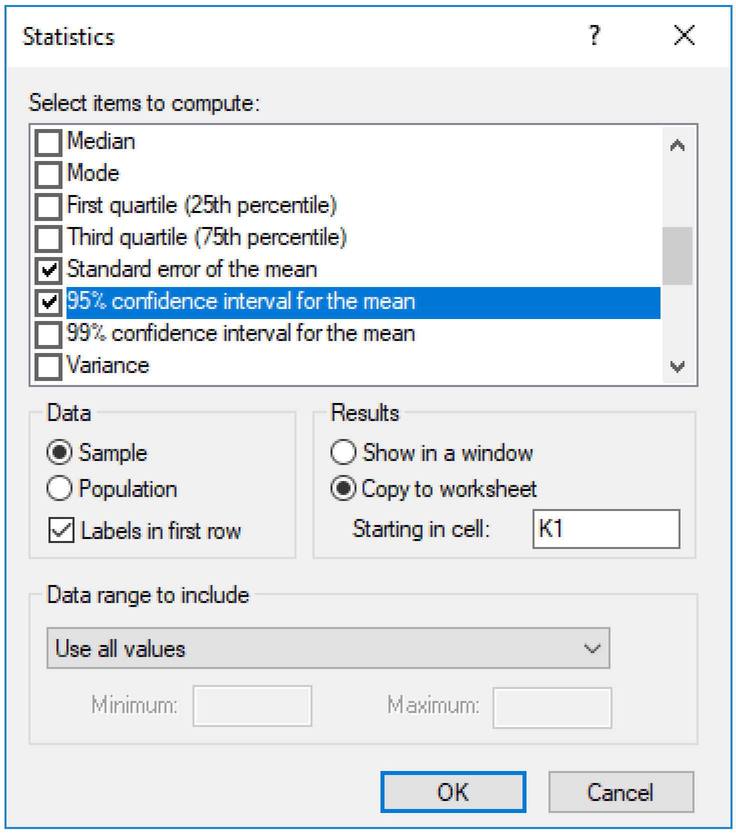
Editing Data

To edit any value, click in the cell to select it. Type information and the existing value is overwritten. Data can be sorted, transformed, or transposed in this window. You can also calculate statistics for the worksheet data in this window. New columns or rows can also be added. For instance, if we notice that the value in cell B13 is incorrect, we can change it.

1. Click in cell B13.
2. Type the value 46.2.
3. Press ENTER on the keyboard. The new value is entered in cell B13.

Calculating Statistics on the Data

Sometimes, it is necessary to know some basic statistical information about the data. For instance, what is the maximum value for each site and how do the average values relate to one another? This information can be calculated in the worksheet. To compare multiple site average values and compare confidence in the values, we could click on each column separately or we could display all of the information at once. To display all of the information at once:



Check all of the desired options and select Copy to worksheet*to copy the results to the existing worksheet.*

1. Click on the header B and hold down the left mouse button. Drag the mouse across all column headers between column B and column I, and then release the mouse button. All Site columns are now selected.
2. Click the **Data Tools | Data | Statistics** command.
3. In the **Statistics** dialog, select the items that should be displayed. In this case, we are interested in the maximum value, average

values, and confidence in the average values. Select *Maximum*, *Mean*, *Standard error of the mean*, and *95% confidence interval for the mean* in the *Select items to compute* list.

4. Select *Copy to worksheet* and set the *Starting in cell* to K1 to display the summary information in the same worksheet as the actual data instead of in a report window.
5. Click *OK* and the information is displayed in columns K through S.

Mean values can be compared visually. The standard error of the mean and 95% confidence value can also be compared. In addition, plots can be created directly from the summary statistics information, if desired.

K	L	M	N	O	P	Q	R	S
	Site A	Site B	Site C	Site D	Site E	Site F	Site G	Site H
Maximum	62.70	64.10	78.90	83.00	69.40	74.40	67.40	71.80
Mean	54.00	45.20	60.23	74.02	48.56	54.19	48.97	51.57
Standard error	1.83	4.32	3.67	1.91	4.46	3.86	4.22	4.20
95% confidence interval	4.04	9.51	8.08	4.20	9.81	8.50	9.28	9.25
Standard deviation	6.36	14.97	12.71	6.61	15.44	13.38	14.61	14.55

Visually inspect the statistical results to compare various site data.

Saving the Data File

When you have completed entering all of the data, the data can be saved in a variety of formats.

1. Click the File | Save As command. The **Save As** dialog is displayed.
2. Specify a save location for the new data file, your *Documents* folder for example.
3. In the *Save as type* list, choose the *XLSX Excel 2007 Spreadsheet (*.xlsx)* option.
4. Type *Tutorial* in the *File name* field if it is not there already.
5. Click the *Save* button.

The file is saved in the XLSX format with the file name you specified. The name of the data file appears in the title bar and on the worksheet tab.

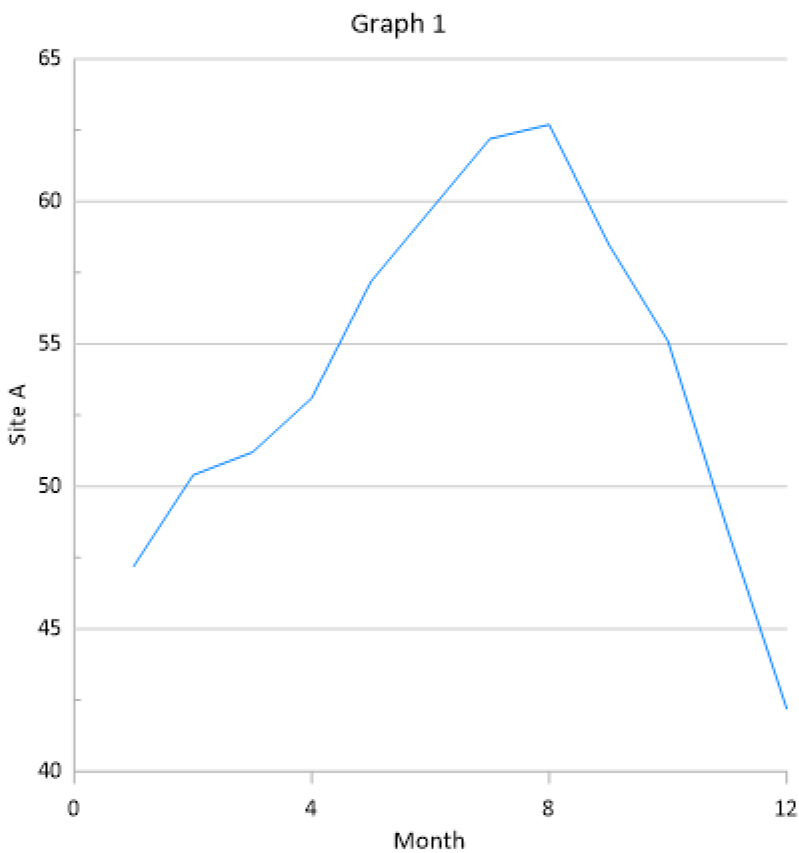
Lesson 2 - Creating a Graph

You can create graphs in several ways in **Grapher**. Graphs can be created with the graph wizard, from the **Home | New Graph** commands, from the worksheet, and from templates. All of these methods are discussed in the *Creating Graphs* help topic.We will use the most common method for the tutorial, creating a graph through the **Home** tab **New Graph** group. We will create a line/scatter plot from an existing data set.

To create a line plot graph:

1. If the worksheet window is still open, click the *Plot1* tab. Alternatively, you can create a new plot window by clicking the File | New | Plot command.
2. Click the Home | New Graph | Basic | Line Plot command.
3. In the **Open Worksheet** dialog, select the *Tutorial.dat* file you saved in Lesson 1. You can select the file in the file list section or in the *Open worksheets* section at the bottom of the dialog. You can open the *Tutorial.dat* sample file if you did not complete Lesson 1.
4. Once the file is selected, click the *Open* button.

A line plot is created using the default properties. By default, **Grapher** uses the first two columns containing numeric or date/time data in the data file. In this example, the X values are in column A and the Y values are in column B.



The line plot is created with the default settings.

Changing the Line/Scatter Plot Properties

You can edit any of the plot properties after the graph has been created. You can edit the columns used to create the plot, the plot line color, the symbol display, and label display, add fill to the plot, or change just about anything you see on the plot.

1. Select the plot by clicking *Site_A* in the **Object Manager**.
2. In the **Property Manager**, select the Line page
3. Set *Style* to *.1 in. Dash*.
4. In the *Plot Line Properties* section, set the *Width* to *0.03 in* (*0.08 cm*).

The **Property Manager** contains all of the properties for the selected object on multiple pages. A line/scatter plot contains Plot, Data Limits, Error Bars, Labels, Symbol, Line, and Fill tabs. Click the tab name to open the property page. You may need to click on the ⊞ or ⊟ buttons next to the section names to access the properties, as discussed in the *Property Manager* help topic.

Adding a New Plot

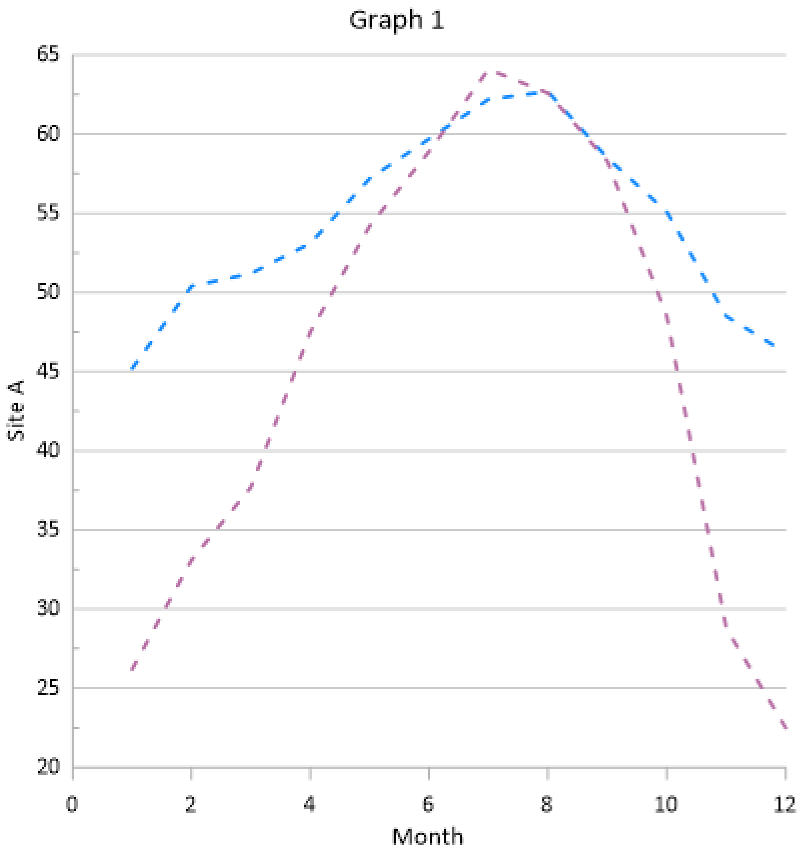
You can add several plots to one graph in **Grapher**. In *Tutorial.dat*, columns B through I are additional Y data, making it simple to add additional plots to the graph. To add a plot to the graph:

1. Click *Site_A* in the Object Manager to select the existing line plot.
2. Click the **Plot** tab in the **Property Manager**.
3. In the *Add to Graph* section, click *Create* next to the *New plot* field to add a new plot to the graph.

Clicking the *Create*button creates a new line/scatter plot using the same worksheet as the original plot. The same axes and plot properties are also used for the new plot, the plot color is automatically changed. The *X column* stays the same and the *Y column* increments to the next column with data. The new plot is selected after the command is executed. The **Property Manager** title changes to **Property Manager - Site_B** and the *Y variable* changes to *Column C: Site B.*

The *New plot* feature in the **Plot** page only creates plots from the original plot's data file. In addition, not all plot types have this option. When many plot types are selected, the **Graphs | Add to Graph** commands are available. These allow additional axes, duplicate axes, plots from a different data file, legends, summation plots, and magnifiers to be added to the selected graph. For additional information on this command, see *Plot -*

Add to Graph. The Graph Wizard can also be used to quickly create a graph with multiple plots from a single data file.



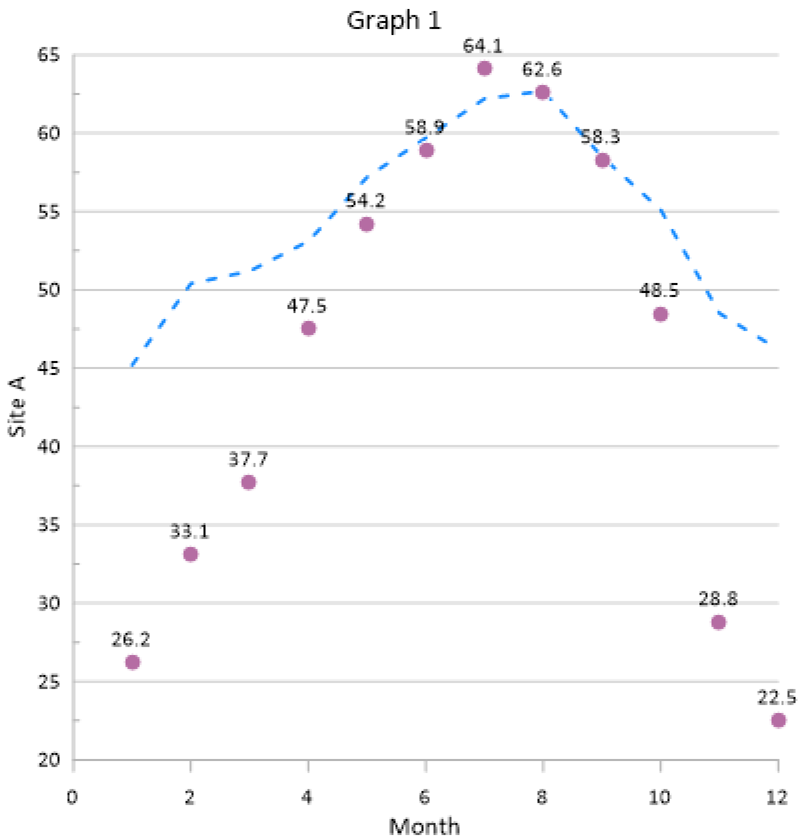
The second line plot is added to the graph using the same axes and properties as the first plot.

Displaying Plot Labels

Labels can be displayed at any data point on the plot. Labels can come from the X or Y data columns or from any other data column in the worksheet. To display labels for the data points:

1. Click *Site_B* in the Object Manager to select the plot.
2. In the Property Manager, click on the **Labels** tab to display the plot labels properties.
3. In the *Label variable* property, select *Column C: Site B* from the list.

The Y data values from column B are shown as data point labels on the plot.



Add plot labels to show values or distinguish between data points.

Moving Labels

Grapher allows you to manually move labels that are displayed for plots and axes with the **Move Labels** command. You can also move axis and graph titles and legend entries with the **Move Labels** command. To move the plot labels:

1. Click *Site_B* in the Object Manager to select the plot.
2. Click the Graph Tools | Plot Tools | Move Labels command. The **Move Labels** command remains highlighted to indicate **Move Labels** mode is active. The first label will appear with a box around it, 

.
3. Click on the label, hold down the left mouse button, and drag the label to the desired location. Alternatively, press the ARROW keys on the keyboard to move the label a small amount.
4. When you are finished moving this label, click on another label to move it. Repeat the clicking on labels and moving until all labels are in the desired location.
5. When finished, press the ESC key on the keyboard or click the

Graph Tools | Plot Tools | Move Labels command againto end moving labels mode.

To return the labels to their original positions, you can use the Graph Tools | Plot Tools | Reset Positions command.

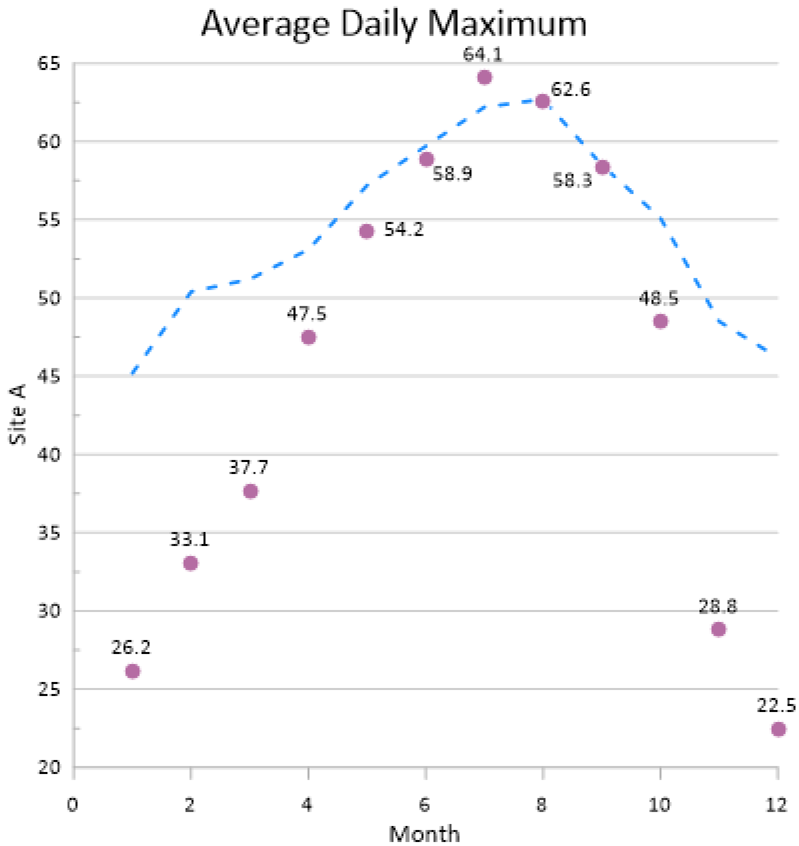
Adding a Graph Title

Graph properties control settings that affect the entire graph, such as titles, background line and fill colors, and fill patterns that fill between multiple plots. Let's edit the graph title and add a fill between the plots in the graph.

To add a graph title:

1. Click on the *Graph 1* object in the **Object Manager** to select the entire graph.
2. Click on the **Title** tab in the **Property Manager**.
3. In the *Text* property field, delete *Graph 1* and type the graph title, *Average Daily Maximum*.
4. Click the ⊞ button next to *Font* to open the section, if necessary.
5. Highlight the current *Size (points)* value and change it to 24.

The *Text* and *Font* properties can be used to quickly add and modify a simple text title. The **Text Editor** can be used to add multiple lines and various fonts, sizes, and colors to the title.



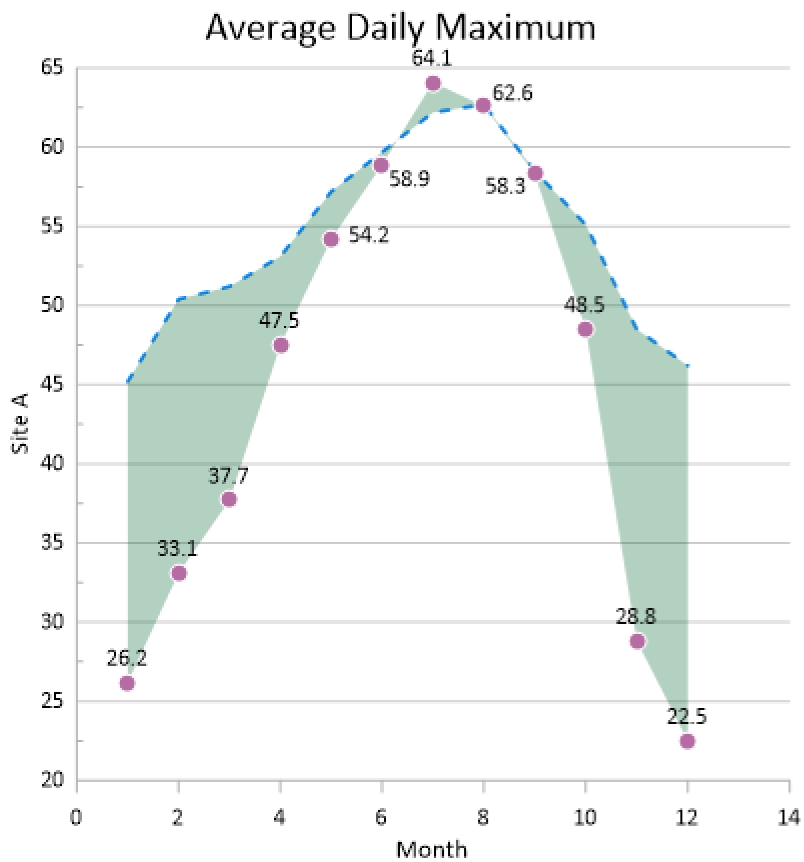
Add a graph title to display additional information about the graph.

Adding a Fill Between Plots

Adding a fill between the two plots will help indicate the difference in values for the plots. Color gradients and/or transparency can be used to enhance the appearance of the fill. To add fill between the plots:

1. Click *Graph 1* in the **Object Manager** to select the graph.
2. Click the **Fill** tab in the **Property Manager**.
3. In the *Between Plots Fill Properties* section, click *Add* in the *Add fill* field. The *Fills* list will be updated with *Fill 1*.
4. Set the *Plot one* property to *Site_A*.
5. Set the *Plot two* property to *Site_B*.
6. Expand the *Fill style* section, if necessary. Set the *Foreground color* to *Forest Green*.
7. Type *30* in the *Foreground opacity* property to set the opacity to 30%.

A semi-transparent green fill has been added between the Site_A line plot and Site_B scatter plot.



The fill between plots highlights the difference in values.

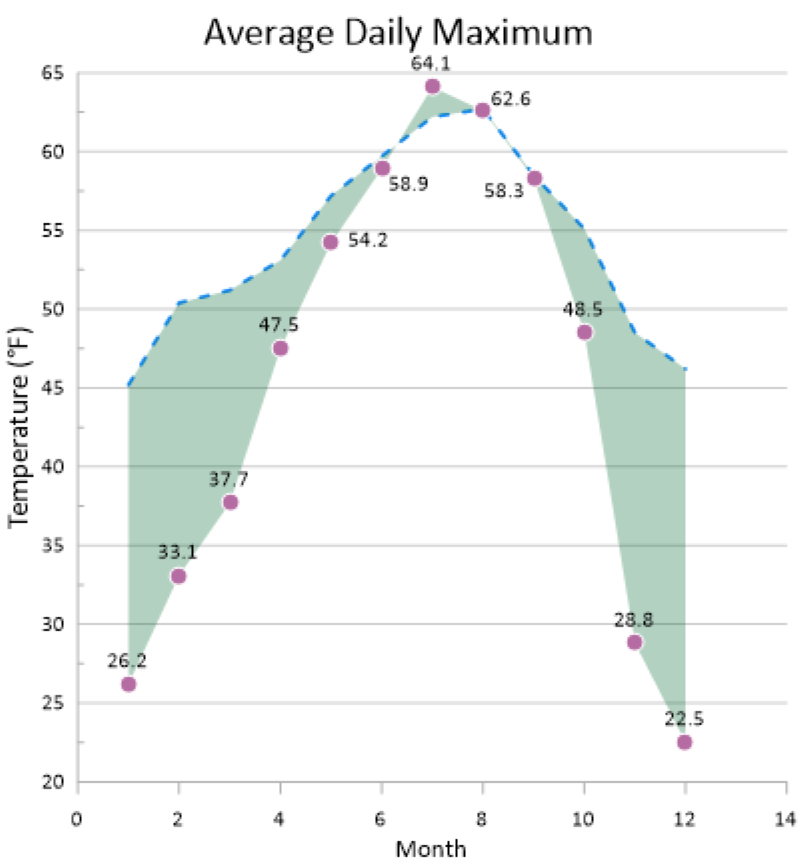
Lesson 3 - Editing Axes

Grapher's axes can be modified to fit any design needs. The axis scale, axis length, tick mark spacing, tick mark labels, axis titles, colors, etc. can all be customized. Once the axis is selected, all of the axis properties are displayed in the Property Manager. Standard axes have Axis, Ticks, Labels, Link Axis, and Line tabs. The axis title options are on the **Axis** tab. By default, the axis title is linked to the first row in the data file. In this example, we will change the Y axis title.

1. Click *Y Axis 1* in the **Object Manager** to select the Y axis.
2. Click the **Axis** tab in the **Property Manager** to edit the axis properties.
3. In the *Title* section, click the Σ button in the *Text* field. The Text Editor opens.
4. In the **Text Editor** dialog, highlight and delete the current linked text, *<<@B1>>*.

5. Type the word *Temperature (F)*.
6. Click in the space just before the *F* and click the button.
7. In the **Symbol Properties** dialog, change the *Symbol Set* to *Calibri* and select the degree symbol, *Number 144*. Click *OK* to return to the **Text Editor**. Alternatively, you can click in the space before the *F* and press and hold the ALT key while typing the number *0176*. This will also insert the symbol, without opening the **Symbol Properties** dialog. This is a good method to use when inserting Unicode or international characters in any text box.
8. Next, let's change the properties of the axis title. In the **Text Editor**, click and drag to highlight the text *Temperature (° F)*.
9. Highlight the current font size and type 18, to make the font 18 points. The font size is located to the right of the font name in the upper left corner of the dialog. Only the highlighted text changes size, so be sure to select all of the text.
10. Click *OK* to close the **Text Editor** and save the changes to the axis title.

The text *Temperature (°F)* now appears along the Y axis.



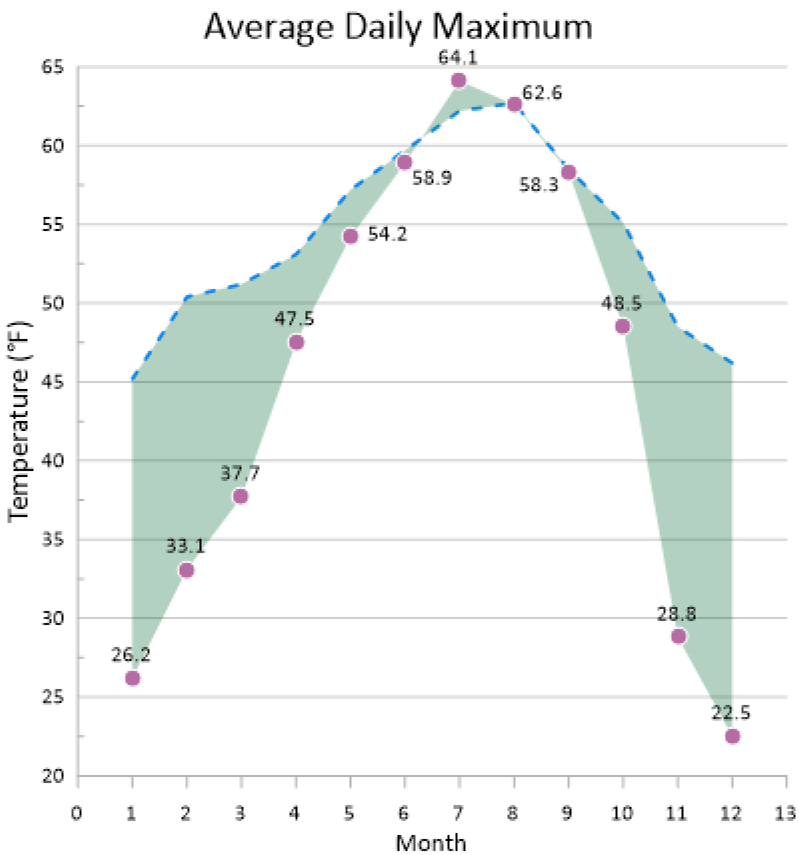
Axis titles are added by selecting the axis and then adding the Text in *the* ***Axis*** *page of the* ***Property Manager****.*

Changing the Tick Mark Spacing

Tick marks are a means of indicating units of measure and are typically equally spaced like the lines on a ruler. Tick marks are the lines that emerge perpendicularly from an axis. Normally, the major tick marks are longer and the minor tick marks are shorter and appear between the major tick marks. For example, in the tutorial graph the major tick mark spacing on the Y axis is five units, e.g., 40, 45, 50, etc. In addition, there is a single unlabeled minor tick mark between each set of major tick marks. In the following exercise, the tick spacing is changed to one for the X axis. To change the tick mark spacing:

1. Click on the *X Axis 1* in the Object Manager to select it.
2. In the Property Manager, click the **Ticks** tab to open the tick mark properties.
3. Click the ⊞ next to *Major Ticks*, if necessary.
4. Change the *Spacing* from 2 to 1. To change the *Spacing*, highlight the existing number 4, type the new number 1, and press ENTER on your keyboard. The word *Auto* is automatically replaced with the word *Custom*, indicating a custom spacing value.
5. Click the ⊞ next to *Minor Ticks*, if necessary. If either the *Show ticks on top* or *Show ticks on bottom* options are selected in the *Minor Ticks* section, clear the check boxes.

Now the major tick marks spacing is 1, and no minor tick marks are displayed.



You can customize the axis properties, including changing the tick mark spacing.

Changing the Tick Labels

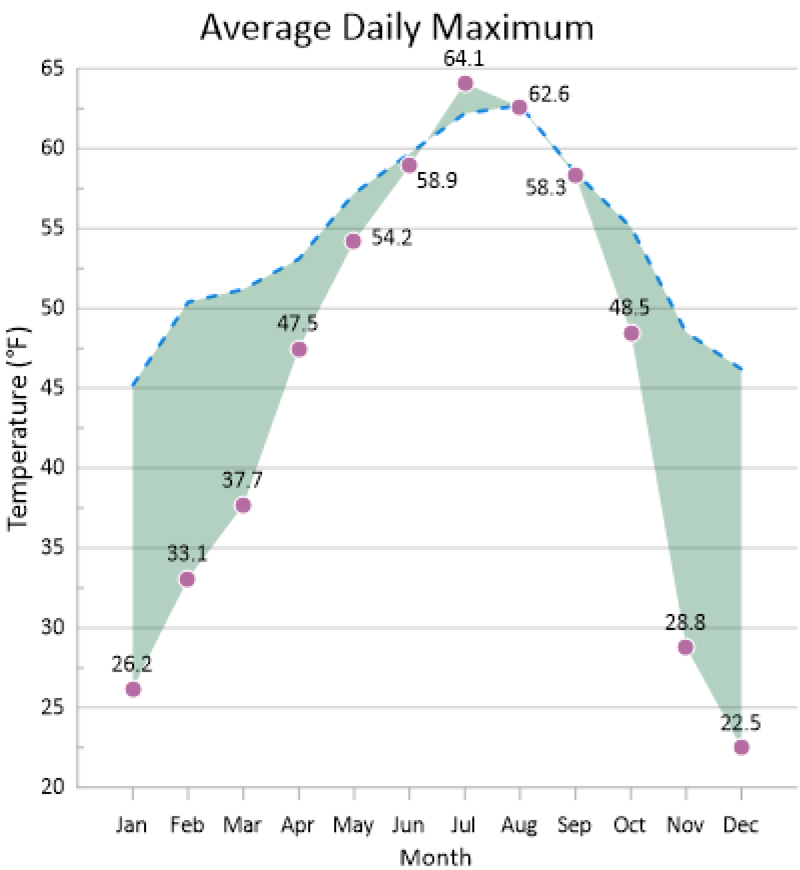
Tick labels can be displayed using different label sources including *Automatic, Date/Time,* and *From worksheet.* Automatic labels are the default, however there may be situations where either using either a number to represent date/time values or labels directly from a worksheet source may be useful. For this tutorial, we will change the X Axis labels to use a data column from the worksheet where we have tick label names specified. To change the tick labels source:

1. Click on the *XAxis 1* in the Object Manager to select it.
2. In the Property Manager, click on the **Labels** tab to open the tick label properties.
3. Click the word *Automatic*next to the*Label source* option and select *From worksheet* in the list. This displays the *Worksheet* properties in the **Labels** page.
4. Next to*Worksheet,*click the word*None*to display a list of open worksheets and the*Browse*option. The*Browse*option would be used to select a worksheet that is not already open. In this tutorial, the worksheet we want to use is already open. Select the*Tutorial.xlsx*file

from the list (or *Tutorial.dat* if you are using the sample file).

5. Next to the*Data variable* property, click the current column and select*Column A: Month*.
6. Next to the *Label variable* property, click the current column and select *Column J: Month Name*.

The graph updates with the worksheet labels defined by the text in Column J of the worksheet.



You can customize tick labels to display information from a column in the worksheet.

If the axis labels or the axis title overlap or need to be moved slightly, the Graph Tools | Plot Tools | Move Labels command can be used to move the axis labels just as the plot labels were moved earlier in the tutorial.

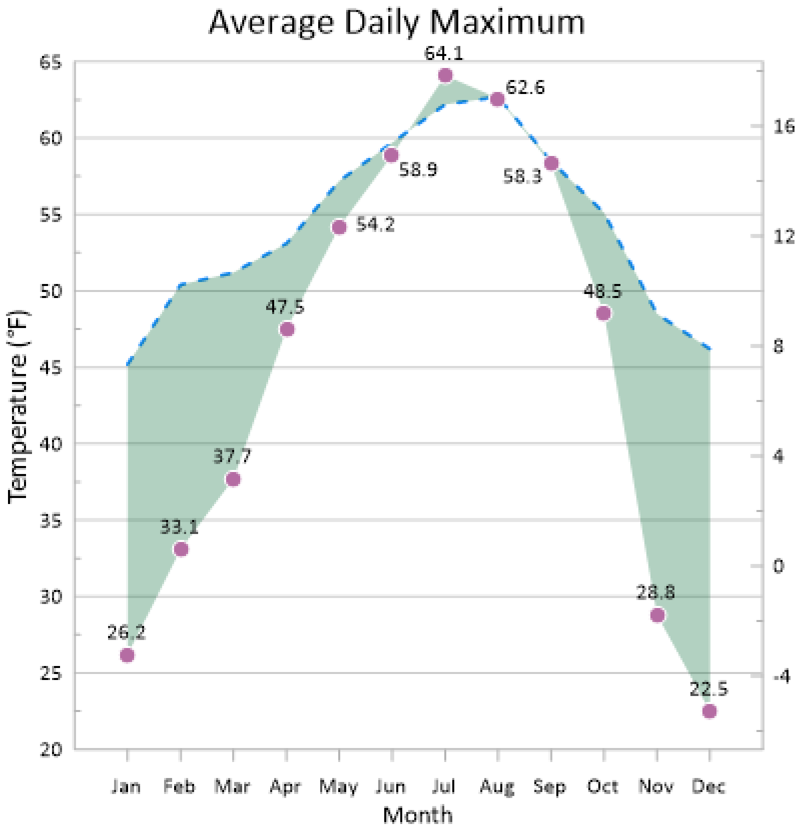
Adding a Secondary Linked Axis

Secondary axes are used to display different scales on the graph. In this example we will add a second Y axis to display temperature in degrees Celsius.

To add a linked axis:

1. Click on the *Graph 1* object in the Object Manager.
2. Click the Home | Add to Graph | Axis | Y Axis command to add a second Y axis.
3. In the Position Y Axis 2 dialog, check the *Flip tick marksand labels* check box.
4. Click *OK*.
5. Click the Link Axis tab in the Property Manager to link the new axis.
6. In the *Link axis* field, click *None* and select *Y Axis 1* from the list.
7. Check the *Link limits* check box.
8. In the *Limits Y = F(X) =* field, highlight the current text, type *(X-32)*5/9*, and press ENTER. The axis limits automatically update to apply the equation to the dependent axis limits. X in the equation refers to the controlling axis. So, the *Minimum* value (40) has 32 subtracted from it and then is multiplied by 5/9 to get the *Minimum* value for the new dependent axis. The same process is used with the *Maximum* value (70) to calculate the dependent axis maximum. The new axis *Minimum* is 4.444 and the *Maximum* is 21.111.
9. We also want the axis to stay located in the same relative position when the graph moves. Check the boxes next to *Link X position* and *Link Y position*. Now, when any portion of the graph is moved, the axis will also move.
10. Click the **Line** tab to open the *Y Axis 2* line properties.
11. In the *Grid Line Properties* section, clear the *Major tick grid line* option to remove the *Y Axis 2* grid lines.
12. Click the **Ticks** tab to open the *Y Axis 2* tick mark properties.
13. In the *Major Ticks* section, select the *Show ticks on left* option.

Now the secondary Y axis is displayed to the right of the graph with a degrees Celsius scale. When the graph is moved or the axis limits change, the *Y Axis 2* automatically updates to stay in the same relative location and the same relative axis limits as *Y Axis 1*. Use the processes from the previous lessons to add an axis title, change the tick mark spacing, and move any overlapping labels if you desire.



Add multiple axes to display alternate scales on the graph.

Lesson 4 - Adding and Editing a Legend

Legends provide information for interpreting a graph. You can add a legend for most plot types. Typically, legends are linked to the graph so that any changes made to the graph are automatically updated in the legend. The legend features, such as font and legend placement, can be customized. To add a legend:

1. Select the entire graph or select any part of the graph by clicking on an object in the graph, such as *Y Axis 1* or *Site_B.*
2. Click the Home | Add to Graph | Legend command.
3. Position the cursor over the legend in the plot window. Click and hold the left mouse button.
4. Drag the legend to any position you wish. Release the mouse button to position the legend in the new location.

A legend is created for the graph using the default properties. Currently, the legend displays *Legend* for the title and the plot names are linked to the names in the **Object Manager**.

*When a legend is first created, it contains the graph and plot names listed in the **Object Manager**.*

Changing the Number of Symbols

The number of symbols in a legend can be set from zero to three. To change the number of symbols:

1. Click on *Legend 1* in the **Object Manager**to select the legend.
2. In the Property Manager, click on the **Legend** tab to open the legend properties.
3. Click the number 2 next to the *Number of symbols* option and select 1 from the list. The legend is updated displaying only one symbol.

Changing the Symbol Size - Tutorial

By default, legend entry symbols are the same size as the symbols in the plot. To change the symbol size to a custom value:

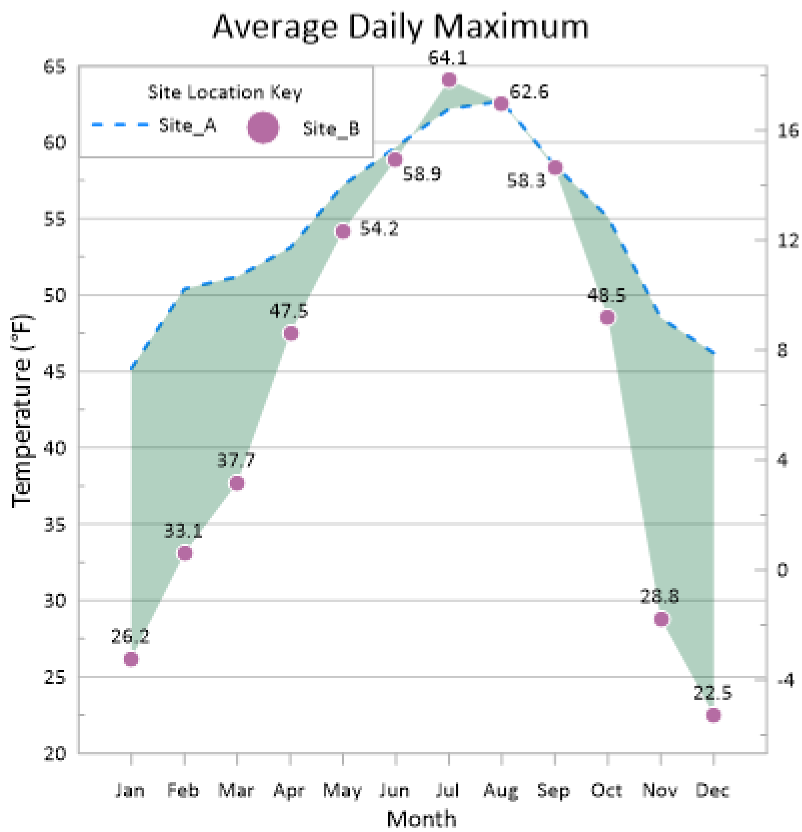
1. Click on*Legend 1*in the**Object Manager**to select the legend.
2. In the**Property Manager**, click on the**Legend**tab.
3. Click the*Edit*buttonnext to the*Entries*option to open the**Legend Entries**dialog.
4. Select *Site_B*in the*Name*column and click the*Symbol Size*button to open the**Symbol Size**dialog.
5. Select the *Custom* option in the *Size* group.
6. Type *0.30* in. (*0.762* cm) in the *Custom* field.
7. Click*OK*in the**Symbol Size**dialog to make the change.
8. Click *OK* in the **Legend Entries** dialog.

The symbol size for Site A in the legend is now 0.3 inches, i.e. slightly lar-ger than the symbols in the plot. If the other plot also displayed symbols, checking the *Apply to all entries* option in the **Symbol Size** dialog would make all plots show the symbols at the specified size.

Creating Multiple Columns in the Legend

Longer legends may need to be split into multiple columns to make the best use of the page space. To separate a legend into multiple columns:

1. Click on *Legend 1* in the **Object Manager** to select the legend.
2. In the **Property Manager**, click the **Legend** tab.
3. Highlight the value next to the *Number of columns* option. Type the value 2, and press ENTER on the keyboard. The legend is updated to show the two columns.



All properties of the legend can be modified.

Lesson 5 - Working with the Script Recorder

Scripter is Golden Software's automation program. You may record your actions in **Grapher** with the **Script Recorder** rather than writing the scripts manually in **Scripter**. See the *Script Manager*, *Introducing Scripter*, and *Script Recorder* help topics for more information about automation. The *Grapher Automation* book in the table of contents contains all of the help topics related to automation.

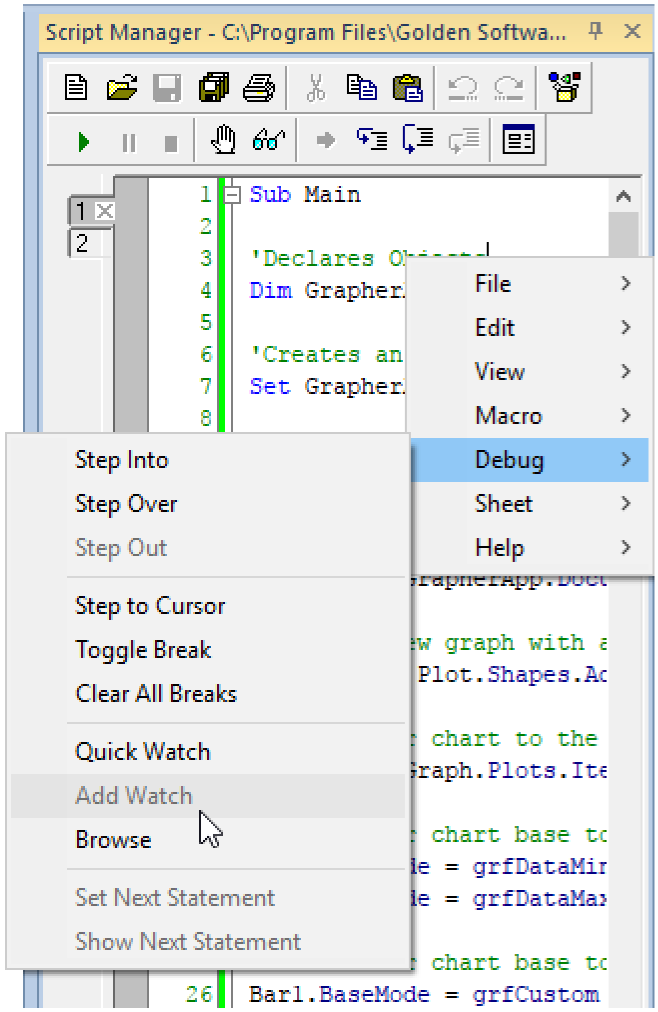
The **Script Recorder** can be used for many tasks. We will provide one scenario to demonstrate the **Script Recorder**. For example, let's say that you receive a data file once a quarter. The file has the same file name each quarter and the same number of columns, but the information contained in the file updates each time. Each quarter you need to create the graphs and then export the graph for reports. You can automate this process with the **Script Recorder**to save time and increase efficiency.

The graph in this example is fairly simple for time's sake, but keep in mind that complex graphs are very well suited to automation. We will record the process of creating a graph, changing some features of a graph, and adding a fit curve. The creation of this graph uses the features included in the previous lessons and includes a few new items. If you do not understand part of the directions, review the material in the previous lessons or consult the online help.

The Script Manager can be used to view scripts as they record.

1. Select the **View | Display | Script Manager** option to display the **Script Manager**.

A check mark is displayed next to visible managers. By default, the **Script Manager** is located at the right of the **Grapher** window, tabbed with the **Worksheet Manager**. Click the **Script Manager** tab to view the **Script Manager**. Right-click in the **Script Manager** to access the menu commands.



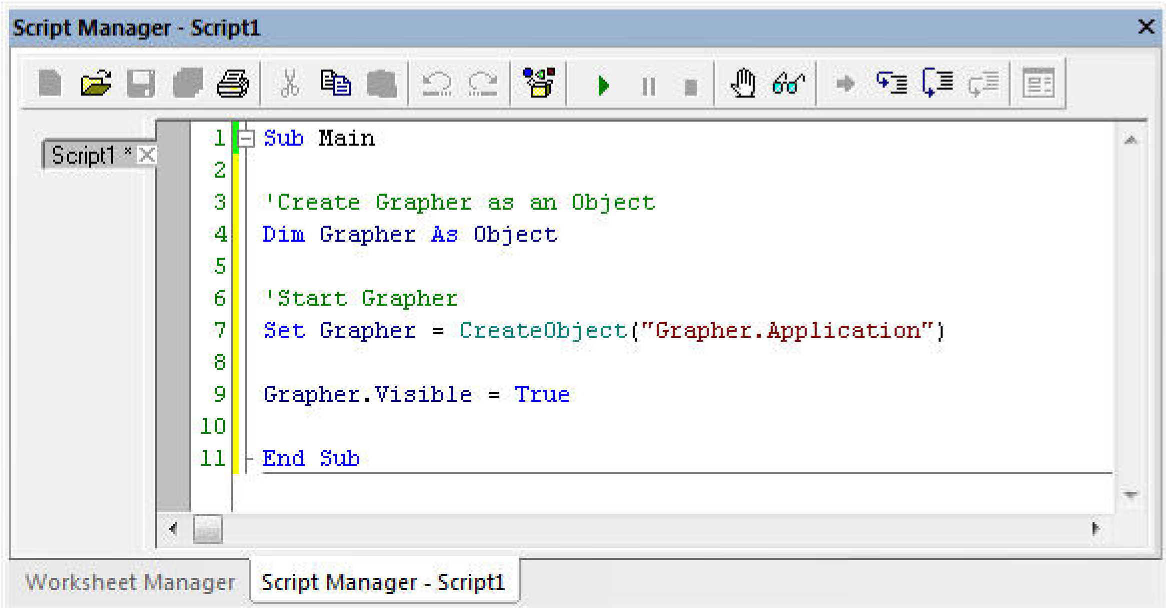
*Click the **Script Manager** tab to view, edit, and run scripts.*

Start Recording

The **Automation** tab is used to start and stop recording scripts. Help for **Grapher** automation and Basic Language help information can also be accessed on the **Automation** tab. To start recording,

1. click the Automation | Scripts | Record command.

The **Record** button changes to **Stop Recording** to indicate that the script is recording. Information appears in the **Script Manager** as soon as recording begins. This code starts **Grapher** when the script is run later. Every action taken will be recorded in the script manager, until the recording is stopped.



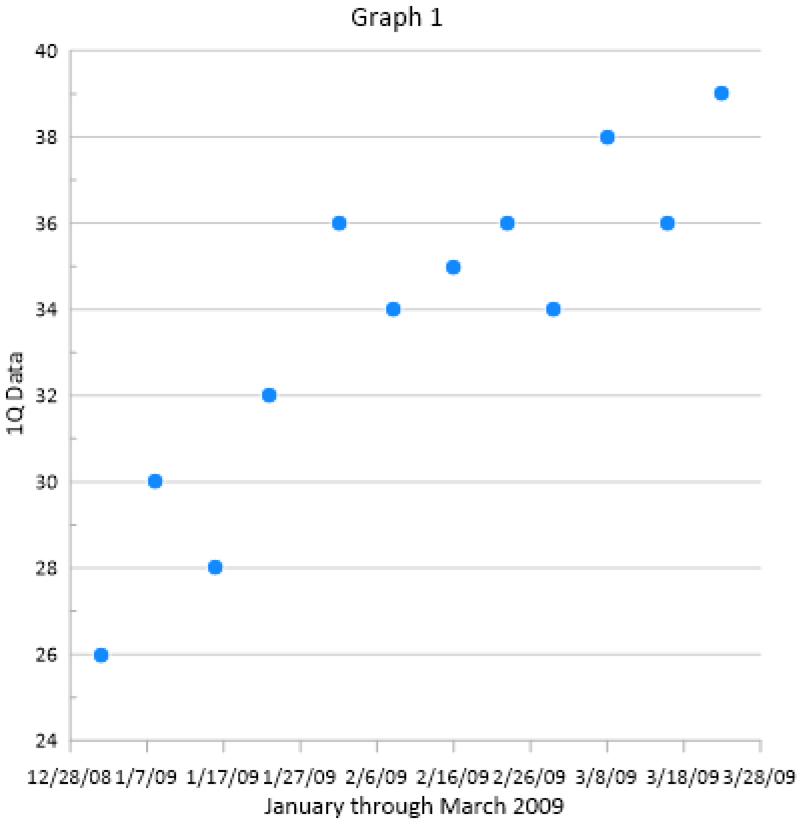
*Code is immediately added to the **Script Manager** when script recording begins. This information starts **Grapher** when the script is run later. The text in green with an apostrophe prefix are comments.*

Creating a Scatter Plot

To create a line plot in a new plot window:

1. Click the File | New | Plot command.
2. Click the **Home | New Graph | Basic | Scatter Plot** command.
3. The **Open Worksheet** dialog appears. Browse to **Grapher's** Samples folder. The location of this folder varies depending on where the software was installed. If the software was installed in the default folder, the path is C:\Program Files\Golden Software\Grapher 15\Samples.
4. Select the *tutorial script recorder.xls* file.
5. Click *Open* to create the default graph and scatter plot.

A scatter plot is created with the first two available columns using the default properties. **Grapher** can create graphs from data containing date/time information. In this example, column A contains dates, so dates are plotted on the X axis.



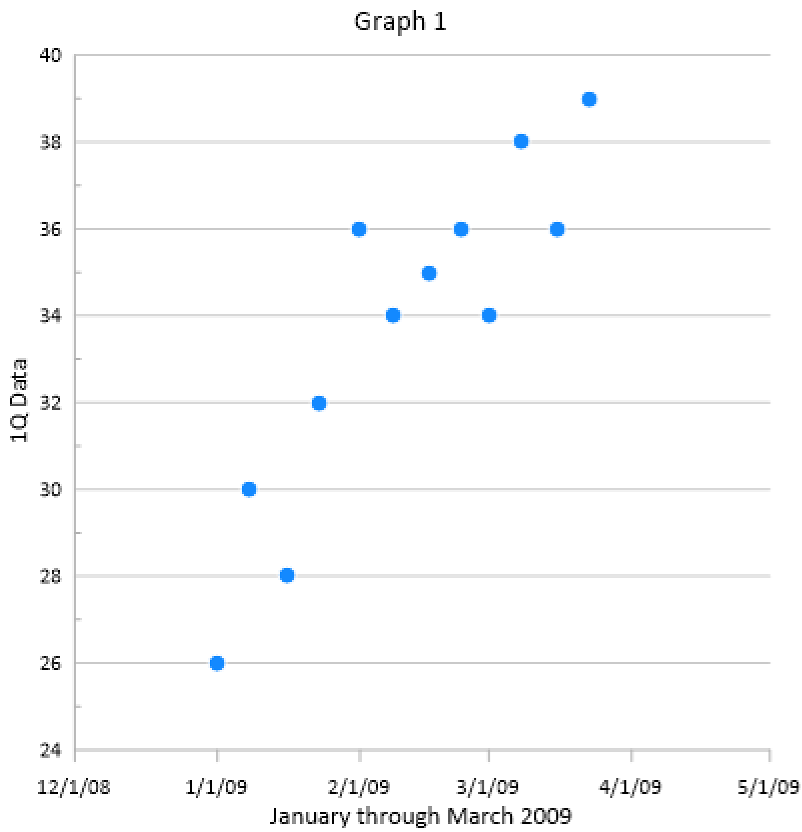
The graph is created with the default properties.

Changing the X Axis Date/Time Tick Mark Spacing

Tick marks can be spaced at any desired interval. Tick marks can be changed to show one tick mark every X number of units or can be based on date/time units, such as minutes, days, months, or years. To set the tick marks to display one tick and label per month:

1. Click on the *X Axis 1* in the **Object Manager** to select it.
2. In the **Property Manager**, click on the **Ticks** tab to display the [tick mark properties]().
3. Click the ⊞ to the left of the *Major Ticks* section to expand the major tick options, if necessary.
4. Check the box next to the *Use date/time spacing* option in the *Major Ticks* section.
5. Next to *Date/time spacing*, click *Every Year* to open the **Date/Time Spacing** dialog.
6. Change *Year* to *Month* and click *OK*.

The X Axis major tick marks are now displayed at 1/1/09, 2/1/09, 3/1/09, and 4/1/09.



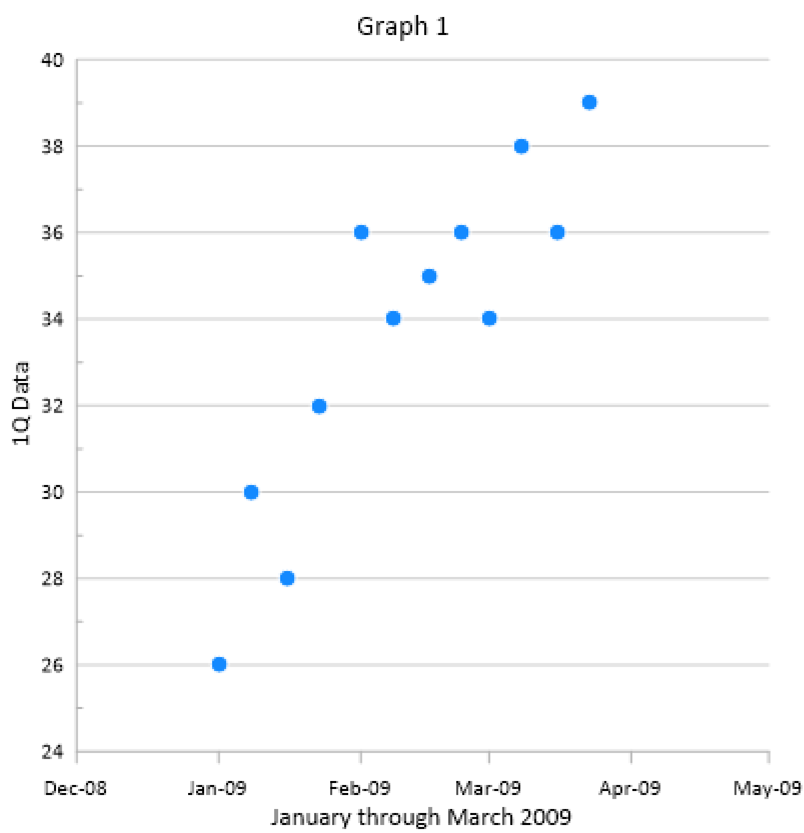
The X Axis tick mark spacing can be based on date/time units.

Changing the X Axis Date/Time Tick Label Format

There are a variety of tick label formatting options available. One of the options is to change the display of the date/time labels. There are many different predefined date/time labels available or you can create your own custom label format. To change the major label format from M/d/yy (1/1/2009) to MMM-yy (Jan-09):

1. Click on the *X Axis 1* in the **Object Manager** to select it.
2. In the **Property Manager**, click on the **Labels** tab to display the tick label properties.
3. Click the ⊞ to the left of the *General* section to expand the major label options, if necessary.
4. Click the *Select* button next to *Major label date/time format* to open the **Date/Time Format Builder** dialog.
5. Type MMM-yy in the *Date/Time format (edit to change)* field.
6. Click *OK*.

The X Axis tick labels are displayed in the *MMM-yy* format. The month abbreviations are determined by your PC's default language setting. You can force a specific language for date/time labels by adding a language identifier before the date/time format.



The X Axis date/time labels can be formatted with a predefined or custom format.

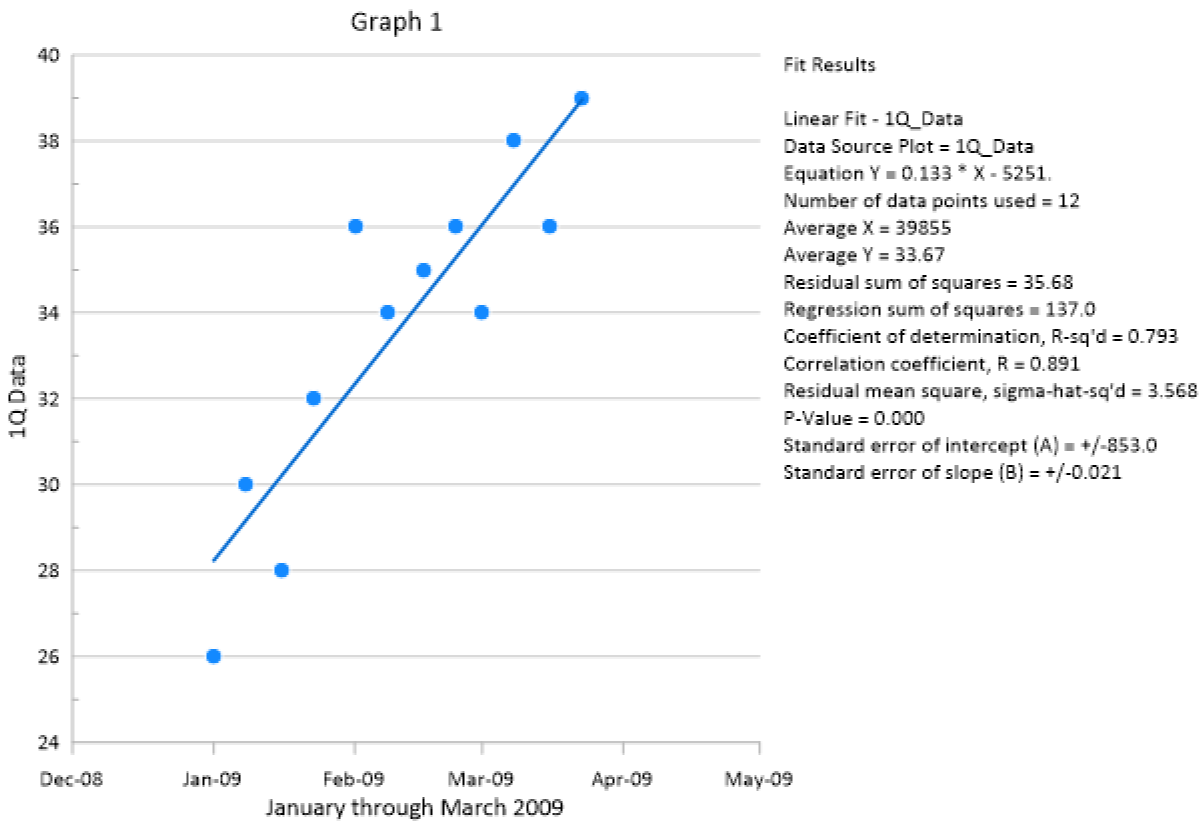
Adding a Fit Curve

Grapher includes many predefined fit curves as well as a tool for creating custom fit curves. XY and histogram data can be fitted, and statistical information can be displayed for the fit curves in the plot or in a report. To add a fit curve,

1. Click *1Q_Data* in the **Object Manager** to select the scatter plot.
2. Click the Home | Add to Graph | Fit Curve command. A linear fit is added by default.
3. Click *Linear Fit - 1Q_Data* in the **Object Manager** select the fit curve.
4. Click the **Plot** tab in the **Property Manager** to display the fit curve properties.

5. Set the *Significant digits* property to *4*.
6. Click *Insert* next to the *Insert into plot document* field. The cursor changes to a crosshair to indicate draw mode.
7. Click the position in the plot window where you want to add the fit statistics.

Now a linear fit curve and various fit statistics are displayed in the plot window.



Adding fit curves helps explore and understand possible relationships in the data.

Stopping and Saving the Script

Now that the graph has been created, it is time to stop recording and save the script. To stop and save the script:

1. Click the Automation | Scripts | Stop Recording command. The **Save As** dialog appears.
2. Select a save location, such as your *Documents* folder, in the **Save**

As dialog.

3. Type *tutorial script recorder* into the *File name* box.
4. Click the *Save* button.
5. Right-click in the **Script Manager** and select **File | Close** to close the script in the **Script Manager**.

The recording is stopped and the *tutorial script recorder.bas* is saved for future use. Congratulations, you have completed the **Grapher** tutorial!

Data Overview

Data files contain the information used to create a graph. Each record in a data file occupies a single row and is comprised of at least two values (X, Y) for most plot types and at least three values for XYZ plots, contour maps, and surface maps (X, Y, Z). At least three values are also required for class plots, floating bar, hi-low-close, bubble, ternary, vector. The X, Y, and Z values are each placed in separate columns. X and Y coordinates define the position of the point on the graph.

Creating Data

Data files can be created in the **Grapher** worksheet, an ASCII editor, or any program that can produce files in one of the file formats listed in the **Open** dialog.

Graphing and Viewing Data

When graphing a data file, the data are loaded into an internal worksheet. It is not necessary to open the data in a worksheet window before creating a graph. If you want to view or alter the data in a data file, you can use the File | Open, Graph Tools | Worksheet | Display, or View | Display | Worksheet Manager commands to gain access to the data.

The order of the data in the file is the order the data are plotted. Descriptive headers in row 1 of each column are helpful but not required. When text appears in row 1 of a column, this text appears in list boxes as column titles. If a number resides in row 1, it is not incorporated into the list boxes, and instead, the column heading (such as column B) is displayed.

Rows with non-numeric entries (empty cells or text) are excluded when graphing. These records are not considered during the graphing operation.

Data File Content

Data files can contain up to one billion columns. Since you can specify the columns to be graphed, your data can occupy any columns. This allows you to have columns containing additional information particular to each point. The data file can contain several columns, so you can produce several graphs using the same data file.

Data files may contain data in addition to the X, Y coordinates. For example, when creating a scatter graph with the Home | New Graph |Basic | Scatter Plot command, additional columns can be used to specify the plot labels and axis labels.

Data File Formats

Import and export worksheet data in several data file formats.

Use **File | Import**to import the following formats into the worksheet:

ACCDB Microsoft Access 2007-2010
BLN Golden Software BLN Files
BNA Atlas BNA Files
CSV Comma Separated Variable CSV Files
DAT Files
DBF Database Files
MDB Microsoft Access 1997-2003 Files
SEG Data Exchange Format
P1 Data Exchange Format
SLK Sylk Spreadsheet Files
TXT Text Data Files
XLS Excel Files
XLSX Excel Files
XLSM Excel Files

Use **File | Open Excel**to import Excel files into a native Excel window.

XLS, XLSX, XLSM Excel Files

Use **File | Save As** to export the following formats from the worksheet:

BLN Golden Software BLN Files
BNA Atlas BNA Files
CSV Comma Separated Variable CSV Files
DAT Files
SLK Sylk Spreadsheet Files
TXT Text Data Files
XLS Excel Files
XLSX Excel Files

Date/Time Formatting

In addition to numbers and text, dates and times are format types in **Grapher**. Dates and times can be used to create a graph, as axis and plot labels, to clip the graph, and to set axis limits.

Using Date/Time Formatting

To use dates and times in **Grapher**, the data need to be formatted as dates and times. One way to format data in **Grapher** is to use the worksheet. The worksheet can be accessed with the File | New | Worksheet, File | Open, Graph Tools | Worksheet | Display, and through the Worksheet Manager. Highlight the column containing dates and times and then select Data Tools | Format | Format Cells to set the column as date/time in the worksheet.

Once the formatting is set to date/time, you can use the date/time information just as you would use numbers in **Grapher**:

- you can plot the data using date/time without converting the dates and times into serial numbers
- you can set the axis limits using dates and times
- you can set plot clipping using dates and times

Date/time information can also be used as plot labels and tick labels.

Date/Time Formatting Tips

- In the worksheet, save data files containing date/time formatting as Excel files to preserve the date time formatting as seen in the worksheet.
- You can save date/time-formatted data files as ASCII files (.DAT, .CSV, .TXT, .BNA, or BLN). Sometimes this is necessary if you exceed the Excel row or column limits. When opening the file in **Grapher's** worksheet, you can make the serial numbers appear as dates by using **Data Tools | Format | Format Cells**.
- If you have formatted the data as date/time in another spreadsheet program such as Excel, the data are formatted as date/time in **Grapher**.
- Whenever possible, enter and display dates and times in one of the many calendar formats, e.g., "6/14/2009" or "14-June-2009", and let the software handle converting to/from internal numeric representations.
- When the recognized format is ambiguous (i.e. 10/7/12), the month, day, and year order is determined by the Windows locale. In some countries, this will be recognized as M/d/yy, in others as d/M/yy, and in others as YY/M/d. It is important to use non-ambiguous

date/time formats when the Windows locale may change.

- If dates/times occur before 1/1/0000, use the BC or BCE suffix after the date. So, Alexander III of Macedon's birthday would be listed as 20-July-356 BCE in the worksheet. Using AD or CE is not necessary and the worksheet will automatically remove these in dates after 1/1/0000.
- The year 0 is defined, according to the ISO 8601:2004 standard.
- When a two digit year is input in the worksheet (00 to 99), it means the year in the current century. For instance, inputting 11/4/13, indicates that the year is 2013, not 0013. In order to have the year 0013, the full four digits (0013) must be input for the date. So, the date would be input as 11/4/0013 CE for November 4, 0013 CE or 11/4/0013 BCE for November 4, 0013 BCE.
- If the data is not displaying like you have specified in the **Label Format** dialog, check the *Use Data/Time Format* box in the *Major Label Text* section of the axes properties Tick Labels page.
- When inputting date/time values in the Property Manager, date/-times must always be entered as MM/dd/yyyy hh:mm:ss. No other formats are permitted in the date/time edit boxes in the **Property Manager.**

Date Time Formats

Date and time formats can be set from the worksheet and from many locations in **Grapher**. Date and time options are case sensitive. Months always need to be entered with upper case M and minutes must always be entered with lower case m.

When dates are parsed during input/import, the month and day of week names must match those of the local language as set in the Windows Control Panel, otherwise the entry will not be recognized as a valid date and will be treated as a text string.

When the recognized format is ambiguous (i.e. 10/7/12), the month, day, and year order is determined by the Windows locale. In some countries, this will be recognized as M/d/yy, in others as d/M/yy, and in others as YY/M/d. It is important to use non-ambiguous date/time formats when the Windows locale may change.

General Date/Time Formats

These are the general date and time formats. These can be used in the worksheet **Format Cells** dialog, in the plot window label format section, or from the **Date/Time Format Builder** dialog. Any combination of these formats can be used in any of these locations.

Skip to the *Predefined Date/Time Formats* section for the allowed linked text formats.

All rows below use the date July 9, 2014 at 6:45:44.12345 in the evening for the *Example*.

Date/Time Code	**Example**	**Description**
d	9	Single digit day, excluding leading zero
dd	09	Double digit day, including leading zero
ddd	Wed	Shortened day of week name
dddd	Wednesday	Full day of week name
M	7	Single digit month, excluding leading zero
MM	07	Double digit month, including leading zero
MMM	Jul	Shortened month name
MMMM	July	Full month name
MMMMM	J	First letter of month name
yy	98	Two digit year
yyyy	1998	Full year
g		Before Common Era designator - Includes space and bce or nothing if ce, lower case
gg	ad	BC/AD designator - Includes space and bc or ad, lower case
ggg	ce	Before Common Era designator - Includes space and bce or ce, lower case
G		Before Common Era designator - Includes space and BCE or nothing if CE, upper case
GG	AD	BC/AD designator - Includes space and BC or AD, upper case
GGG	CE	Before Common Era designator - Includes space and BCE or CE, upper case
h	6	Single digit hours - 1-12, excluding leading zero
hh	06	Double digit hours - 01-12, including leading zero
H	18	Hours - 0-23 military, excluding leading zero

HH	18	Hours - 00-23 military, including leading zero
[h]	1003914	Hours portion of total time, excludes leading zeros
m	45	Minutes - 0-60, excluding leading zero
mm	45	Minutes - 00 to 60, including leading zero
[mm]	45	Minutes portion of total time, includes leading zeros
ss	44	Seconds - 0-60, rounded to the nearest second
ss.0	44.1	Seconds - 0-60, rounded to the nearest tenth of a second
ss.00	44.12	Seconds - 0-60, rounded to the nearest hundredth of a second
ss.000	44.123	Seconds - 0-60, rounded to the nearest millisecond
ss.0000	44.12345	Seconds - 0-60, maximum precision
[ss]	44	Seconds portion of total time, includes leading zeros
tt	pm	am or pm designator, lower case
TT	PM	AM or PM designator, upper case
\		escape character - output next character verbatim
'...'		output ALL characters between single quotes verbatim, including escape character
[$-xxxx]	[$-409]	xxxx is an up to four hex digit representation of a locale ID

Predefined Date/Time Formats

The predefined date/time formats are the only formats that can be used inside the linked text brackets <<date/time>> when creating linked text via typing in the Text Editor or automation. You can combine predefined formats by writing separate <<date/time>> fields in the **Text Editor** or script. For example, you can type <<M/d/yy>> <<h:mm TT>> in the **Text Editor** to display both time and date.

If you cannot create the desired format by combining predefined date/time formats, consider using the *Insert Date/Time* button in the **Text Editor**.

All rows below use the date July 9, 2014 at 6:45:44.12345 in the evening for the *Example*.

Date/Time Code	Example	Description
M/d/yy	7/9/14	Single digit month, Single digit day, two digit year - separated by forward slash
MM/dd/yy	07/09/14	Two digit month, day, and year - separated with forward slash
MMM dd, yyyy	Jul 09, 2014	Shortened month name, two digit day, four digit year - separated by spaces and a comma
MMMM dd, yyyy	July 09, 2014	Full month name, two digit day, four digit year - separated by spaces and a comma
d-MMM-yy	9-Jul-14	Single digit day, shortened month name, two digit year - separated by hyphens
d-MMM	9-Jul	Single digit day, shortened month name - separated by hyphens
MMM-yy	Jul-14	Shortened month name, two digit year - separated by hyphen
MMM-yyyy	Jul-2014	Shortened month name, four digit year - separated by hyphen
MMMM-yyyy	July-2014	Full month name, four digit year - separated by hyphen
h:mm TT	6:45 PM	clock Hours and minutes with AM/PM designator
h:mm:ss TT	6:45:44 PM	Hours, minutes, and seconds with AM/PM designator
HH:mm	18:45	24-hour clock hours and minutes
HH:mm:ss	18:45:44	24-hour clock hours, minutes, and seconds
M/d/yy HH:mm	7/9/14 18:45	Single digit month, single digit day, two digit year, 24-hour clock hours and minutes
yyyy	2014	Four digit year
yy	14	Two digit year
MMMM	July	Full month name
MMM	Jul	Shortened month name
MM	07	Two digit month
M	7	Single digit month

dddd	Wednesday	Full day name
ddd	Wed	Shortened day name
dd	09	Two digit day
d	9	Single digit day
d/M/yy	9/7/14	Single digit day, single digit month, two digit year - separated by forward slash
dd/MM/yy	09/07/14	Two digit day, two digit month, two digit year - separated by forward slash
yy/MM/dd	14/07/09	Two digit year, two digit month, two digit day - separated by forward slash
yyyy-MM-dd	2014-07-09	Four digit year, two digit month, two digit day - separated by hyphen

Data in the Plot

In the plot window, there are several ways to ascertain the data used in the plot and to update the data.

- Click the Graph Tools | Worksheet | Display command to open the data used to create the graph. The data opens in the **Grapher** worksheet. You need to select a single plot to activate the command. If any other objects are selected, e.g., entire graphs, axes, titles, drawing objects, the **Display** command is not available.
- Click Graph Tools | Worksheet | List to view the path and file names of all the data files used in the current **Grapher** document.
- Use the *Auto Track Worksheets* option on the **Plots** page of the **File | Options** dialog to automatically show changes in the **Grapher** worksheet on the graph. If *Auto Track Worksheets* is disabled, changes made to the worksheet do not show on the graph. Note that this command only applies to changes made in the **Grapher** worksheet.
- The File | Reload Data command is used to apply changes to a graph when changes to the data are made in programs other than **Grapher**. For example, if you have a data file open in Excel and make changes to the data file, you can use **File | Reload Data** to display the changes in the graph.

List Worksheets

Click the **Graph Tools | Worksheet | List** command to view the path and file names of all the data files used in the current **Grapher** document.

Display Worksheet

Click the **Graph Tools | Worksheet | Display** command to open the data used to create the graph. The data opens in the **Grapher** worksheet. You need to select a single plot to activate the command. If any other objects are selected, e.g., entire graphs, axes, titles, drawing objects, the **Display** command is not available.

Auto Track Worksheets

Use the *Auto track worksheets* option to automatically show changes in the **Grapher** worksheet on the graph. To enable or disable *Auto track worksheets*, click the File | Options command. On the left side of the dialog, click on **Plots**. On the right side of the dialog, check or uncheck the box next to *Auto track worksheets.*

If *Auto track worksheets* is disabled, changes made to the worksheet do not show on the graph. This command only applies to changes made in the **Grapher**worksheet. If changes are made in a program other than **Grapher**, use the File | Reload Data command to update the data.

Reload Worksheets

The **File | Reload Data** or **Graph Tools | Worksheet | Reload** command is used to apply changes to a graph when changes to the data are made in programs other than **Grapher**. For example, if you have a data file open in Excel and make changes to the data file, you can use the **Graph Tools | Worksheet | Reload** command to display the changes in the graph.

To show changes in a graph when data is edited in another program:

1. Make changes to the data in a program other than **Grapher**.
2. Save the changes in the other program. If you do not save the changes, they will not appear in the graph.
3. Click the **File | Reload Data** or **Graph Tools | Worksheet | Reload** command.

If you are editing your data in the **Grapher** worksheet, use Auto Track Worksheets, not **Reload**. If you make changes in the **Grapher** worksheet and do not save the changes, using the **Graphs | Worksheet | Reload** command removes the data changes.

Change Worksheets

Click the **Graph Tools | Worksheet | Change** command to change the paths for all worksheet references in the current plot document. The **Change** command updates the *Worksheet* property for ALL plots in the document to the selected folder. The **Change** command does not affect the file name.

The **Change** command cannot be undone with the Undo command. If the incorrect path is selected in the **Select Folder** dialog, use the **Change** command again to select the desired path. Alternatively, you can close the document without saving and reopen the document.

To change the worksheet paths:

1. Click the **Graph Tools | Worksheet | Change** command.
2. Select the desired location in the **Select Folder** dialog
3. Click *Select Folder* in the **Select Folder** dialog.

The *Worksheet* property in the **Plot** page of the Property Manager will be updated for all plots in the document to the new path.

New Path Contains Data

When the new path contains files with the same file name as the old path, the plots will be automatically updated with the data in the new location.

New Path Does Not Contain Data

When the new path does not contain files with the same file name as the old path, the plots will be unchanged as long as the document is open in **Grapher**. However, once the document is saved, closed, and reopened you will be prompted to update the file paths if the data files are not in the specified path.

Worksheet Window

The worksheet window contains commands to display, edit, enter, and save data. The worksheet window has several useful and powerful editing, transformation, and statistical operations available. Several import and export options are available for opening data files from other spreadsheet programs. The **Data Tools** tab is automatically selected when you open or switch to a worksheet document.

Worksheet Commands

Some commands are not available when viewing a worksheet. For example, none of the Insert and Layout commands are available and only a few of the Home and View commands are available.

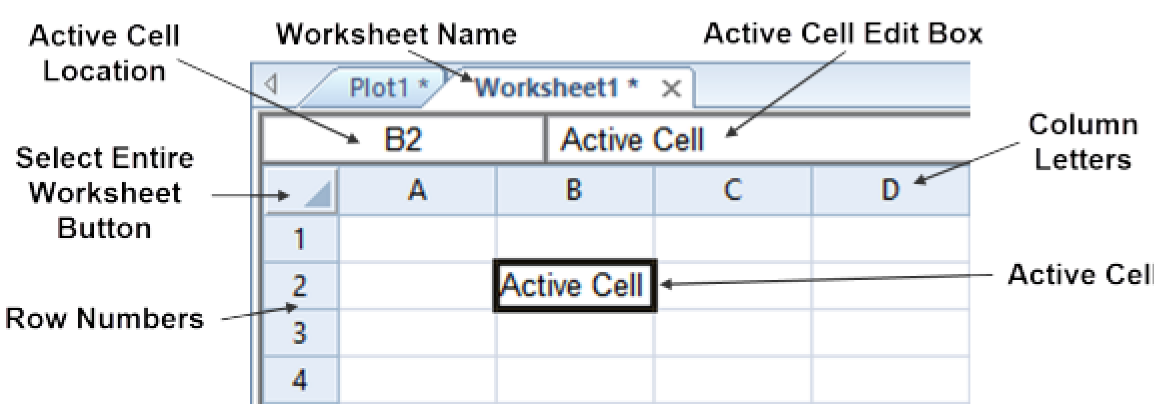
File	Opens, closes, saves, imports, exports, and prints files. Provides links to online references and email templates. Provides access to licensing information and **Grapher** version number.
Home	Contains clipboard, undo, and graph creation commands.
View	Controls the display of toolbars, managers, status bar, tabbed documents, and the window layout.
Automation	Contains links to record or run a script and open the automation or BASIC language help files.
Data Tools	Contains commands for modifying the worksheet appearance, editing the data file, and analyzing the data.

The Application/Document Control menu commands control the size and position of the application window or the document window.

Worksheet Window

To enter data in a worksheet, use the File | Open command to open an existing data file or click the File | New | Worksheet command to create a blank worksheet. Data already used to create plots can be opened in the worksheet window with the Graph Tools | Worksheet | Display command.

The components of the worksheet window are discussed below.



The components of a worksheet window shown above are described in the following table.

Column Letters	The column letters identify a column in the worksheet.
Row Numbers	The row numbers identify a row in the worksheet.
Active Cell	The active cell is highlighted with a bold outline. The active cell receives data input (numeric values or text strings) from the keyboard. Only one cell is active at a time.
Active Cell Location	The active cell location is specified by column letter and row number.
Active Cell Edit Box	The active cell edit box displays the contents of the active cell. Data typed into an empty cell appears in both the edit box and the active cell.
Worksheet Name	The worksheet name displays the data file name or the worksheet number if the data file has not been saved.
Select Entire Worksheet Button	The select entire worksheet button is used to select all cells in the worksheet.

Opening a Worksheet Window

You can view, enter, or modify data in the worksheet document.

To view worksheet data:

- Click the File | New | Worksheet command to open a new blank worksheet.
- Click the  button to open a new blank worksheet.
- Click the File | Open command. In the **Open** dialog, select a data set, and click the *Open* button.
- If there is an open worksheet window, return to it at any time by clicking on the tab with that worksheet name displayed.

Open Excel

The **File | Open Excel** command opens an .XLS, .XLSX, or .XLSM file using Excel. All commands and features of Excel are available in **Grapher** when using this command. You can easily create graphs from the Excel window using the **New Graph** menu commands. The Excel window **New Graph** menu commands are the same as the **Grapher** Home | New Graph commands.

An Excel file opened with the **File | Open Excel** command cannot be saved to the same file name. Excel locks the file so that it can only be saved in the open Excel window using the **File | Save As** command. This is an Excel limitation. To save the changes, choose the **File | Save As** command and save the Excel file to a new file name.

Note: With older .XLS files and the 64-bit version of **Grapher**, the **File | Open Excel** command will sometimes open the file directly in Excel, not in the **Grapher** window. This is because Excel is opening the file in a compatibility mode not supported by Excel's automation interface. The file can be opened in Excel and saved to a newer format to be able to edit the file in **Grapher**.

Active Cell Functions

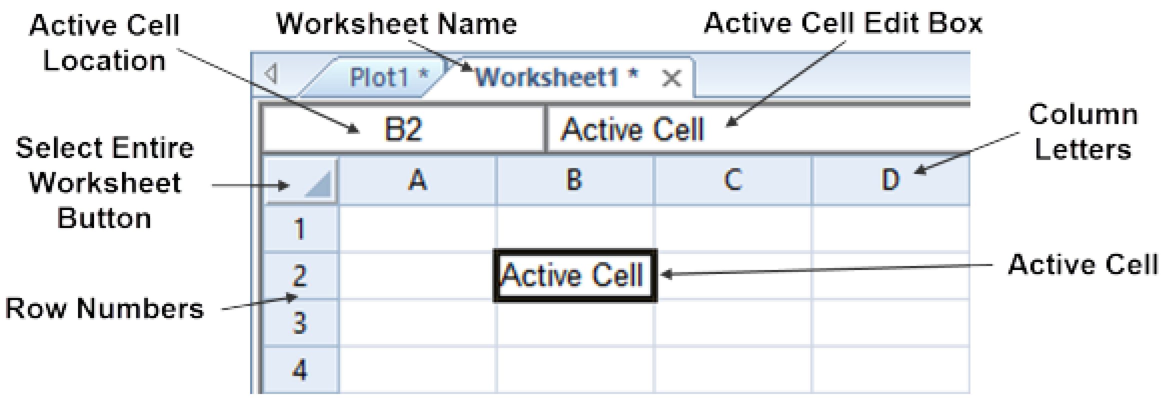
Enter or edit data in the active cell. The contents of the active cell are displayed in the active cell edit box. To edit existing data, activate the desired cell and press the F2 key or highlight the information in the active cell edit box.

Special key functions when editing the active cell are:

- ENTER stores the contents of the cell edit box and then moves the active cell down one cell.
- CTRL+ENTER completes the entry and keeps the current cell active.
- Left and right ARROWS move within the cell's text if the F2 key has been pressed. Otherwise, these keys store the contents of the cell edit box and then move the active cell to the left or right.
- DELETE deletes the character to the right of the cursor if the F2 key has been pressed. Otherwise, pressing the delete key deletes the entire contents of the cell.
- BACKSPACE deletes the character to the left of the cursor if the F2 key has been pressed. Otherwise, pressing the backspace key deletes the entire contents of the cell.
- Up and down ARROWS store the contents of the cell edit box in the active cell and move the active cell above or below.
- TAB stores the contents of the cell edit box in the active cell and moves the active cell to the right.
- SHIFT+TAB store the contents of the cell edit box in the active cell and moves the active cell to the left.

Active Cell Location Box

The active cell location box shows the location of the active cell in the worksheet. Letters are the column labels and numbers are the row labels.



This example shows the active cell as cell B2. The name of the active cell "B2" is listed in

the active cell location box in the upper left portion of the worksheet.

Active Cell Edit Box

The cell edit box is located at the top of the worksheet window just above the column letter bar. The cell edit box shows the contents of the active cell and is used for editing cells. Use the cell edit box to see the contents of a worksheet cell when the column is too narrow to display all of the cell contents.

To begin editing the selected cell, press the F2 key. Alternatively, highlight the contents of the cell edit box to edit the cell. To overwrite the current cell contents, simply begin typing without pressing F2. If the mouse is clicked on a new cell, the new cell becomes the active cell.

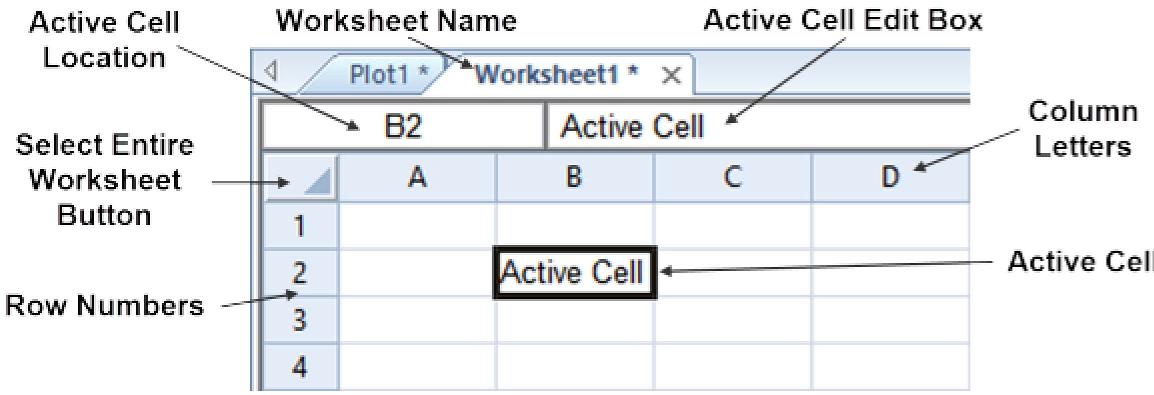
Right-click in the active cell edit box to access the following commands in the context menu:

Right to left Reading order	Toggles right to left reading order on or off.
Show Unicode control characters	Toggles the display of Unicode control characters on or off.
Insert Unicode control character	Select a Unicode control character from the list, and it is inserted in the active cell edit box at the cursor location.
Open/Close IME	When a user types a phonetic representation of a word, the IME displays a candidate list on the

	screen. The user can select the intended word or phrase from among several different possible representations in the candidate list, and the user's selection then replaces the phonetic representation in the document. This command toggles the IME on or off.
Reconversion	IME reconversion allows users who are typing in Japanese to convert back and forth between the phonetic spelling of a word (using the standard Western keyboard) and the Japanese character that represents the word.

Special key functions when editing the active cell are:

- ENTER stores the contents of the cell edit box and then moves the active cell down one cell.
- CTRL+ENTER completes the entry and keeps the current cell active.
- Left and right ARROWS move within the cell's text if the F2 key has been pressed. Otherwise, these keys store the contents of the cell edit box and then move the active cell to the left or right.
- DELETE deletes the character to the right of the cursor if the F2 key has been pressed. Otherwise, pressing the delete key deletes the entire contents of the cell.
- BACKSPACE deletes the character to the left of the cursor if the F2 key has been pressed. Otherwise, pressing the backspace key deletes the entire contents of the cell.
- Up and down ARROWS store the contents of the cell edit box in the active cell and move the active cell above or below.
- TAB stores the contents of the cell edit box in the active cell and moves the active cell to the right.
- SHIFT+TAB store the contents of the cell edit box in the active cell and moves the active cell to the left.



This example shows the active cell as cell B2. The name of the active cell "B2" is listed in the active cell location box in the upper left portion of the worksheet. The active cell edit box is at the top right displaying "Active Cell".

Working with Worksheet Data

There are three ways to enter data into the worksheet. Data are entered into the worksheet using File | Open to open a data file, typing data directly into the worksheet, or copying the data from another application and pasting it into the worksheet.

Entering Data into a Cell

Edit the contents of a cell by making it the active cell. The active cell is positioned by clicking on a cell with the mouse, by using the ARROW keys, PAGE UP, PAGE DOWN, TAB, HOME, END, and SHIFT+TAB. Press the F2 key or highlight the contents of the active cell edit box to edit the contents of the cell.

To enter new data and delete the old, position the active cell and begin typing. Edit mode is entered automatically and the old data is deleted. Pressing ENTER, Up or Down ARROWS, TAB, SHIFT+TAB, PAGE UP, or PAGE DOWN keys cause the edit changes to be recorded permanently in the cell. After pressing F2 or highlighting the cell edit box use the HOME, END, BACKSPACE, DEL, and ARROW keys to edit the cell. Pressing ESC while editing a cell cancels the changes and restores the original data.

Moving the Active Cell

You can designate any worksheet cell as the active cell by left-clicking on it with the mouse. The active cell can also be repositioned by using keyboard commands. The active cell is the cell with a thick border drawn around it. The following actions can be used to move the active cell:

- ARROW keys (Up, Down, Left, Right) move the active cell to an adjacent cell.
- PAGE UP/PAGE DOWN moves the active cell up or down by the number of rows visible in the window.
- HOME moves the active cell to the first occupied cell in the current column. Pressing HOME again moves the active cell to the top row in the current column.
- END moves the active cell to the last occupied row in the current column. Pressing END again moves the active cell to the bottom row of the worksheet.
- ENTER moves the active cell down one row and ends "edit mode."
- TAB moves the active cell right one column and ends "edit mode."
- SHIFT+ENTER moves the active cell up one row and ends "edit mode."
- SHIFT+TAB moves the active cell left one column and ends "edit mode."
- CTRL+HOME moves the active cell to the top cell of the left most column in the worksheet (A1).
- CTRL+END moves the active cell to the bottom occupied row of the last occupied column in the worksheet.
- The CTRL+LEFT ARROW behavior depends on the position of the active cell. If the active cell is to the right of the last occupied column in the current row, it moves the active cell to the last occupied column in the current row. If the active cell is in or to the left of the last occupied column in the current row, but to the right of the first occupied column in the current row, it moves the active cell to the first occupied column in the current row. Otherwise, CTRL+LEFT ARROW moves the active cell to the first column in the current row.
- The CTRL+RIGHT ARROW behavior depends on the position of the active cell. If the active cell is to the left of the first occupied column in the current row, it moves the active cell to the first occupied column in the current row. If the active cell is in or to the right of the first occupied column in the current row, but to the left of the last occupied column in the current row, it moves the active cell to the last occupied column. Otherwise, CTRL+RIGHT ARROW moves the active cell to the last column in the current row.
- The CTRL+UP ARROW behavior depends on the position of the active cell. If the active cell is below the bottom occupied row in the current column, it moves the active cell to the bottom occupied row in the current column. If the active cell is below the top

occupied row in the current column, but in or above the bottom occupied row in the current column, it moves the active cell to the top occupied row in the current column. Otherwise, CTRL+UP ARROW moves the active cell to the first row in the current column.

- The CTRL+DOWN ARROW behavior depends on the position of the active cell. If the active cell is above the top occupied row in the current column, it moves the active cell to the top occupied row in the current column. If the active cell is above the bottom occupied row in the current column, but below the top occupied row in the current column, it moves the active cell to the bottom occupied row in the current column. Otherwise, CTRL+DOWN ARROW moves the active cell to the last row in the current column.

Moving the Active Cell within Selections

The ENTER, TAB, SHIFT+ENTER, and SHIFT+TAB keys move the active cell within a group of selected cells without canceling the selection.

Pasting Data

If data are copied to the clipboard from another software application, the contents of the clipboard can be pasted into the worksheet. If the source application is Microsoft Excel, some formatting information is retained. When pasting data into the worksheet, select a cell and use Home | Clipboard | Paste (CTRL+V). Any data to the right or below the active cell is overwritten, so be sure to locate the active cell carefully. When data are copied to the clipboard, special formatting information is also copied. The Home | Clipboard | Paste | Paste Special command determines the format in which the contents are pasted into the worksheet.

Data Tools Tab

Use the commands on the Data Tools tab to edit, search, format, sort, view statistics, transform the data using mathematical functions, or transpose the data.

Worksheet Error Codes and Special Numeric Values

There are a few different error codes and special numeric values that can appear in a worksheet cell depending on the type and nature of the data that appears.

Codes	Explanation
#########	number does not fit in the column, i.e., the column

	must be wider for the number to be shown
#N/A	value cannot be computed, e.g., not enough data to calculate a statistic
#DIV/0!	an attempt to divide-by-zero was made in performing a calculation
#ERROR	a value could not be computed, e.g., square root of a negative number
#OVERFLOW	value is too large for the worksheet (largest absolute value is about 1.797E+308)
1.#INF	value is too large for the worksheet, i.e., "infinite" value surpassed
1.#IND	numeric value is indefinite (usually the result of performing a calculation with an infinite value or attempting to divide by zero)

Selecting Cells

The keyboard and the mouse may be used to select cells. Selected cells are indicated by reverse video (white background becomes black, etc.). Hidden cells are selected if their columns or rows are within a selected block of cells. Single cells, a rectangular block of cells, one or more rows, one or more columns, or the entire worksheet can be selected.

Cells may be selected to:

- Perform editing and clipboard functions.
- Compute statistics for selected cells.
- Set cell properties for several cells via the Data Tools tab, such as column width, row height, and cell format.

There are several ways to select cells:

- Clicking on the small box above the row labels and to the left of the column label bar selects the entire worksheet.
- To deselect all selected cells, click the left mouse button anywhere within the worksheet, or move the active cell with an ARROW key or other movement key.
- To rapidly select a large block, first select one corner of the block, and then use the scroll bars to scroll to the opposite corner. Hold down the SHIFT key and click on the cell at the opposite corner. The PAGE UP, PAGE DOWN, HOME, and END keys may also be used, but the SHIFT key must be held down while these keys are pressed. The SHIFT key is not needed while using the scroll bars.
- To select all cells in a column or row, click the column letter or row number. To select several adjacent columns or rows, press and hold the left mouse button and drag the pointer on the column

letters or row numbers. To deselect a single row or column from a multiple row or column selection, hold CTRL and click the row or column label.

- While holding down the CTRL key, the active cell may be repositioned for selecting a new block.
- The CTRL key is used to select multiple blocks and the SHIFT key is used to resize the last selected block. Details and exceptions are given in separate help sections for selecting with the mouse and selecting with the keyboard.
- If entire rows or columns are selected by clicking on the headers, some operations, such as statistics, can take a long time. Rather than clicking on the headers, only select the cells containing data.
- Clicking and holding the left mouse button while dragging the mouse in the worksheet selects a block. Similarly, using the SHIFT key plus the ARROW keys selects a block.
- The keys used with SHIFT for selecting cells are the ARROW keys, PAGE UP, PAGE DOWN, HOME, and END. TAB and SHIFT+TAB cannot be used.
- While holding down the SHIFT key, the last selected block may be resized. Use the SHIFT key and the mouse or the SHIFT key and ARROW keys.
- The active cell is at one corner (or edge) of a selected block and must first be positioned before selecting multiple cells.
- The last block cannot be resized if the active cell has been moved.

Selecting Cells with the Keyboard

The keyboard may be used to select cells. Selected cells are indicated by reverse video (white background becomes black, etc.).

To Select	**Process**
Single cells	Click in the cell to select it, or use the arrow keys to select a cell. The selected cell has a thick outline around it.
A rectangular block of cells	Move the active cell to one corner of the block. While holding down the SHIFT key, use the movement keys to position the opposite corner of the block. The movement keys include the ARROW keys, PAGE UP, PAGE DOWN, HOME, and END, but not TAB and SHIFT+TAB. When the block has been sized, release the SHIFT key. To resize the block, see the instructions below.
Several adjacent rows	Select the first or last row. Then, while holding down the SHIFT key, use the vertical movement keys. These include up ARROW, down ARROW, PAGE UP, PAGE DOWN, HOME, and END.

Several adjacent columns	Select the first or last column. Then, while holding down the SHIFT key, use the right and left ARROW keys.

Resize Last Selected Block

To resize the last selected block, hold down the SHIFT key while using the movement keys (as appropriate to the type of block). The last block cannot be resized if the active cell has been moved.

Deselect All Selected Cells

To deselect all selected cells, click the left mouse button anywhere within the worksheet or move the active cell with an ARROW key or other movement key.

Selecting Cells with the Mouse

The mouse may be used to select cells. Selected cells are indicated by reverse video (white background becomes black, etc.).

To Select	**Process**
Single cells	Click on the cell with the left mouse button. The selected cell has a thick outline around it.
A rectangular block of cells	Move the active cell to one corner of the block. Click and hold the left mouse button, and drag it to the opposite corner of the block. Then release the mouse button.
An entire row	Click the mouse on the row label.
Several adjacent rows	Click and hold the mouse on the first row label and drag it to the last row. Make sure the cursor is a normal cursor not the double arrow cursor used for selecting row dividing lines. Hold CTRL and click a row label to deselect the row while keeping the other rows selected.
An entire column	Click the mouse on the column label.
Several adjacent columns	Click and hold the mouse on the first column label and drag it to the last column. Make sure the cursor is a normal cursor not the double arrow cursor used for selecting column dividing lines. Hold CTRL and click a column label to deselect the column while keeping the other columns selected.

The entire worksheet	Click on the small box above the row labels and to the left of the column label bar.

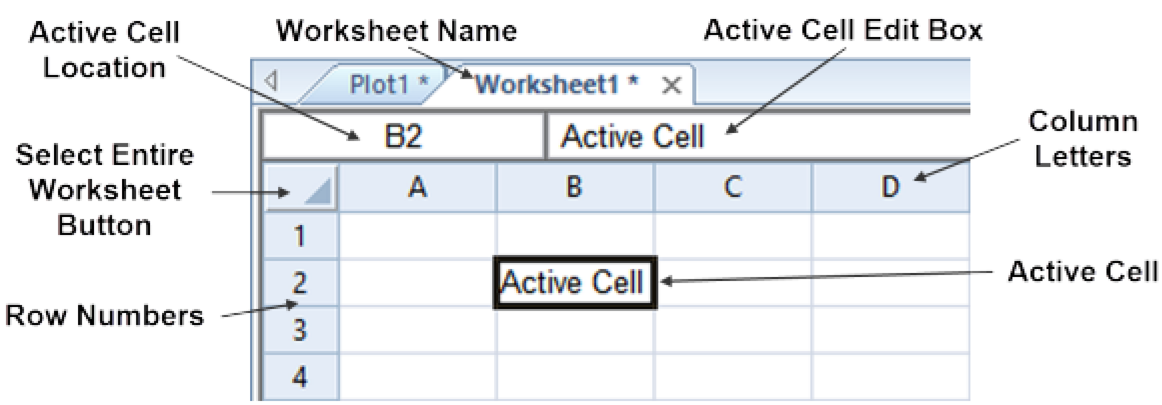
The worksheet scrolls automatically if the mouse is dragged past the visible limits of the worksheet.

Select Additional Blocks
To select additional blocks, hold down the CTRL key while clicking.

Resize the Last Selected Block
To resize the last selected block, hold down the SHIFT key while clicking and holding the left mouse button. Then, drag the edge of the last selected block to the new position. The last block cannot be resized if the active cell has been moved.

Deselect All Selected Cells
To deselect all selected cells, click the left mouse button anywhere within the worksheet or move the active cell with an arrow key or other movement key.

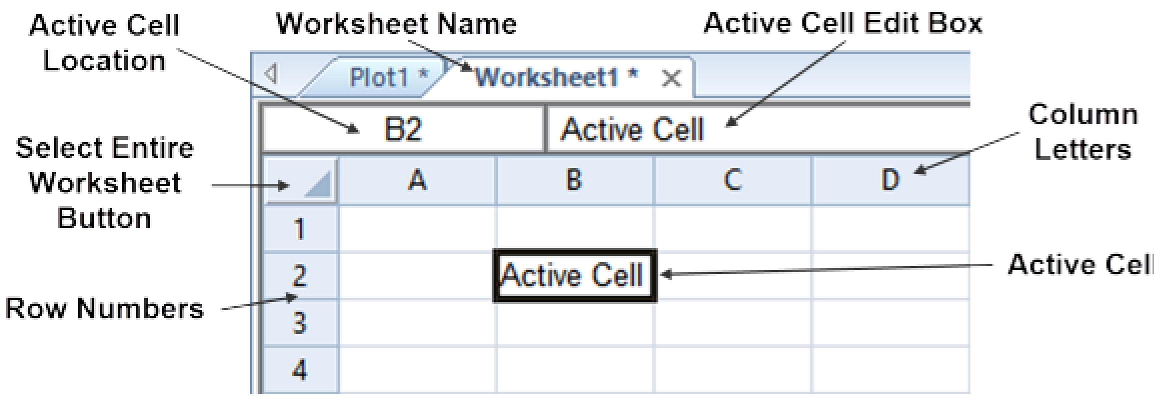
Select Entire Worksheet
Clicking on the small box above the row labels and to the left of the column labels selects the entire worksheet.



The Select Entire Worksheet button is located to the left of column A and above row 1.

Row and Column Label Bars

The worksheet cells are located by column label bars (A, B, C...) or row label bars (1,2,3...). Click the label to select entire rows or columns, to change row height, to change column width, or to hide or unhide rows and columns. To select multiple rows or columns, drag the mouse over several adjacent labels.

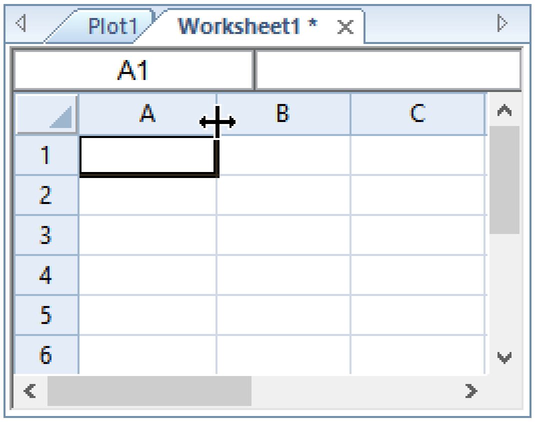


This example shows columns A, B, C, and D, and rows 1, 2, 3, and 4.

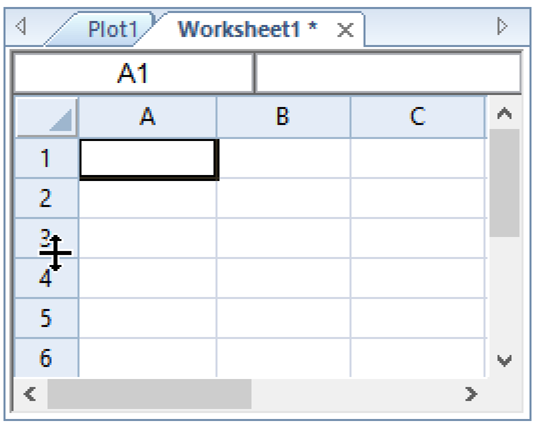
Selecting a Column or Row Dividing Line

The column or row dividing lines are the lines between the column letter labels and row number labels along the borders of the worksheet. These lines divide the columns or rows. When selecting a dividing line, the cursor must be within approximately a character's width of the dividing line and it must be on the label bar.

You can change the column width or row height by dragging the dividing line. Rows or columns can be hidden or unhidden by using the mouse. The Column Width or Row Height commands can also be used to set column widths or row heights.



This example shows the cursor being used to change the width of column A.



This example shows the cursor being used to change the height of row 3.

Worksheet Technical Specifications

The following technical specifications for the worksheet include the number of cells allowed in the worksheet and the nature of the numbers allowed in the worksheet.

- Maximum number of rows in a worksheet: 1 billion
- Maximum number of columns in a worksheet: 1 billion
- Approximate memory requirements (for unformatted numeric data): 10.5 bytes per cell + 24 bytes per column
- Maximum numeric precision (counting the digits before and after the decimal place): 15 digits
- Maximum numeric resolution (the smallest detectable difference

between two numbers): 2.22E-16

- Maximum absolute value (the largest value that can be represented): 1.79769E+308
- Minimum absolute value (the smallest value that is different from zero): 2.22507E-308

Example 1

This example has 10,000 rows of numbers in three columns.

30,000 cells x 10.5 bytes/cell = 315,000 bytes (308 Kbytes)

3 columns x 24 bytes/column = 72 bytes

TOTAL MEMORY NEEDED (in addition to memory needed to run the program): 380 Kbytes

Example 2

This example has three rows of numbers in 10,000 columns.

30,000 cells x 10.5 bytes/cell = 315,000 bytes (308 Kbytes)

10,000 columns x 24 bytes/column = 240,000 bytes (234 Kbytes)

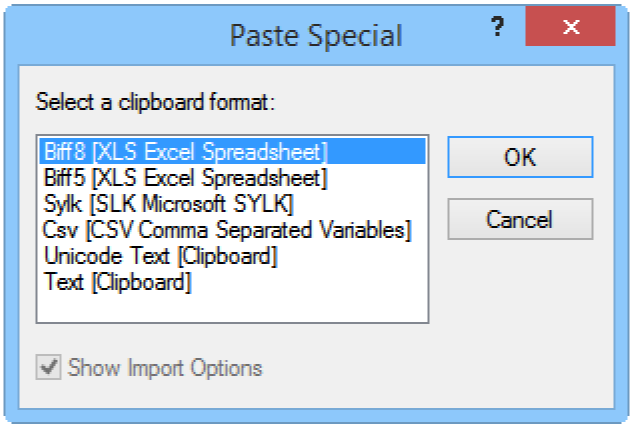
TOTAL MEMORY NEEDED (in addition to memory needed to run the program): 542 Kbytes

Paste Special - Worksheet

When data are copied to the clipboard special formatting information is also copied. Use the **Paste Special** dialog to determine the format in which the contents are pasted into the worksheet. The **Paste Special** command can also be used to remove text formatting. See the *Paste Special* topic for selecting the format when pasting in the plot window.

Paste Special Dialog

The **Home | Clipboard | Paste |Paste Special** command opens the **Paste Special** dialog.



Select a paste special format in the ***Paste Special*** *dialog. This example shows options after copying Excel data and using the* ***Paste Special*** *command.*

The clipboard formats displayed in the **Paste Special** dialog may vary depending on from where the information was copied. For example, data copied from the **Grapher** worksheet may yield different options than data copied from Excel.

Biff8 [Excel Spreadsheet]
The *Biff8 [Excel Spreadsheet]* format is a Microsoft Excel Binary Interchange File Format (BIFF) version 8.

Biff5 [Excel Spreadsheet]
The *Biff5 [Excel Spreadsheet]* format is a Microsoft Excel Binary Interchange File Format (BIFF) version 5.

Biff4 [Excel Spreadsheet]
The *Biff4 [Excel Spreadsheet]* format is a Microsoft Excel Binary Interchange File Format (BIFF) version 4.

Biff3 [Excel Spreadsheet]
The *Biff3 [Excel Spreadsheet]* format is a Microsoft Excel Binary Interchange File Format (BIFF) version 3.

Biff [Excel Spreadsheet]
The *Biff [Excel Spreadsheet]* format is a Microsoft Excel Binary Interchange File Format (BIFF).

Sylk [Microsoft SYLK]
The *Sylk [Microsoft SYLK]* format is a symbolic link Microsoft file format typically used to exchange data between applications, specifically

spreadsheets. The Sylk file format is composed of only displayable ANSI characters, allowing it to be easily created and processed by other applications, such as databases.

Csv [Comma Separated Variable]
The *Csv [Comma Separated Variable]* format is comma delimited with double quotes around text strings (non-numeric or mixed alpha numeric)

Text [Clipboard]
The *Text [Clipboard]* format is unformatted text.

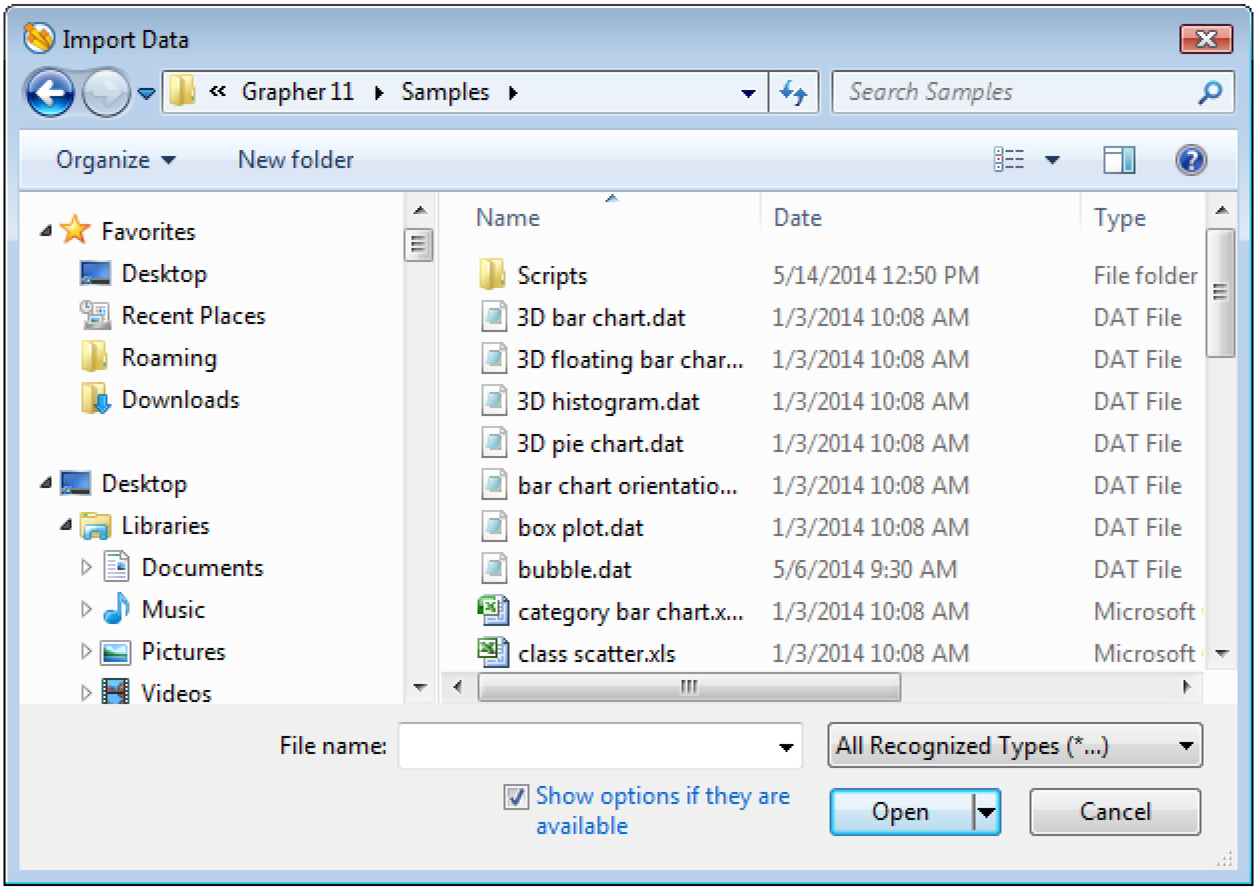
Unicode Text [Clipboard]
The *UnicodeText [Clipboard]* format is unformatted text from a Unicode source.

Show Import Options
When *Unicode Text [Clipboard]* or *Text [Clipboard]* is selected, the *Show Import Options* option is available. Check the box to open the Data Import Options dialog before importing the data.

Import - Worksheet

The **File |Import** or **Data Tools | Edit | Import** command loads the contents of a data file into the existing worksheet. Select the file to merge with the existing file in the **Import Data** dialog. The contents of the new file are imported into the worksheet at the active cell so be sure to position the cell at the edge of the existing data. Any cells in the existing worksheet that lie to the right of and below the active cell are overwritten with the contents of the new importing file.

Multiple files can be opened at one time into the same worksheet with **File | Import** using the SHIFT or CTRL keys while selecting files in the dialog.



*Specify files to import into the worksheet using the **Import Data** dialog.*

Look In

The *Look in* field shows the current directory. Click the down arrow to see the directory structure and click on the folders to change directories.

Creating New Folders and Changing the View

The buttons to the right of the *Look in* field allow you to create new folders and change the view of the file list.

File List

The *File list* displays files in the current directory. The current directory is listed in the *Look in* field. The *Files of type* field controls the display of the file list. For example, if DAT Data (*.dat) is listed in the *Files of type* field only *.DAT files appear in the files list.

Specify a File Name

The *File name* field shows the name of the selected file. Alternatively, type a path and file name into the box to open a file.

Files of Type

The *Files of type* field controls the display of the file list. For example, if DAT Data (*.dat) is listed in the *Files of type* field only *.DAT files appear in the files list.

The *All Recognized Types (*...)* format type is selected by default. This displays all the common file formats in the navigation pane. If a different format type is selected, **Grapher** will remember the setting until the end of the current session. When **Grapher** is restarted, the default format type will be used.

To see all files in the directory, choose *All Files (*.*)* from the *Files of type* list. Double-click on a file to open it or single-click the file and then click the *Open* button. The *All Files (*.*)* option shows all of the file formats in the current directory, even if the file type is not appropriate for the action chosen. For example, a GRD file may be displayed, even though a GRD file cannot be imported into the worksheet. Select a file type from the *Files of type* drop-down list.

Show Options If They Are Available

If *Show options if they are available* is checked, then opening .TXT files or ASCII text files with unsupported file extensions will bring up the Data Import Options dialog where you can specify the import options.

Reload Data - Worksheet

The worksheet **Data Tools | Reload Data** command reloads the worksheet contents from a saved version of the file. This is useful when you make changes to the data file in another program (e.g. Excel) and want the changes to appear in **Grapher**. Save the contents of the file in the other program before selecting the **Reload Data** command. When the data are reloaded, any previous changes made to the original data are overwritten. If you import the data and plan to make changes, do not use **Data Tools | Reload Data**, as there is no **Undo** command for it.

Imported databases appear in a new worksheet window. Once the worksheet is saved, the link to the database is removed.

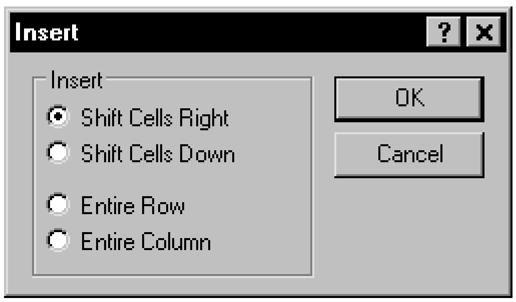
If you wish to reload data in the plot window, click the **File | Reload Data** or **Graph Tools | Worksheet | Reload** command.

Clear - Worksheet

The **Data Tools | Edit | Clear** command removes data from selected worksheet cells. The cells are left empty when the data are removed. To shift the data from unselected cells into the selected cell locations, use the Delete command.

Insert - Worksheet

The **Data Tools | Edit |Insert** command inserts a single blank cell or a block of blank cells in the worksheet. Select cells in the area to insert cells. In the **Insert** dialog, click either the *Shift Cells Down* or *Shift Cells Right* option button and then click *OK*. The blank cells are inserted and the original contents of those cells are moved accordingly to make room for the new empty cells. Click *Entire Row* or *Entire Column* to insert an entire row or column in the area that contains highlighted cells.



*When using **Home | Edit | Insert**, you can shift cells to the right or down to make room for the new cells.*

Shift Cells Right or Shift Cells Down

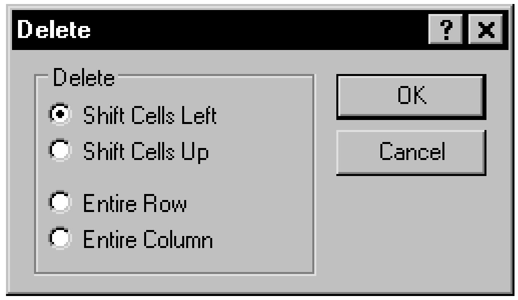
Click the *Shift Cells Down* or *Shift Cells Right* option to insert blank cells and displace the original contents either down or to the right.

Entire Row or Entire Column

Click the *Entire Row* or *Entire Column* option to insert an entire row or column in the area that contains highlighted cells.

Delete - Worksheet

The **Data Tools | Edit | Delete** command deletes the selected worksheet cells and shifts cells up or to the left to fill in the gap. After selecting **Data Tools | Edit | Delete**, the **Delete** dialog appears. Specify the desired behavior of the cells in the **Delete** dialog and click *OK*. The selected cells are deleted and the contents of cells below or to the right are moved to fill the deleted block.



*When using **Home | Edit | Delete**, you can shift cells to the left or up to fill in the gap.*

Shift Cells Left or Shift Cells Up

Click *Shift Cells Up* or *Shift Cells Left* option button to specify if cells will be shifted to the left or shifted up to fill in the gap after deleting the selected cells.

Delete Entire Row or Entire Column

Click *Entire Row* or *Entire Column* to delete the entire row or column that contains highlighted cells.

Leave Deleted Cells Empty

To leave the selected cells empty when the data are removed, use the Clear command, press the DELETE key, or use the Cut command.

Find - Worksheet

The **Data Tools | Find | Find** command is used to find a particular word or phrase in the worksheet. The Find and Replace dialog opens to allow entry of search parameters.

Find Next - Worksheet

The **Data Tools | Find | Find Next** command is used to find the next instance of a particular number, word, or phrase in the worksheet. Each cell matching the search parameters remains selected.

If the **Data Tools | Find | Find** command was not used initially, the Find and Replace dialog opens so that you can define your search criteria.

Replace - Worksheet

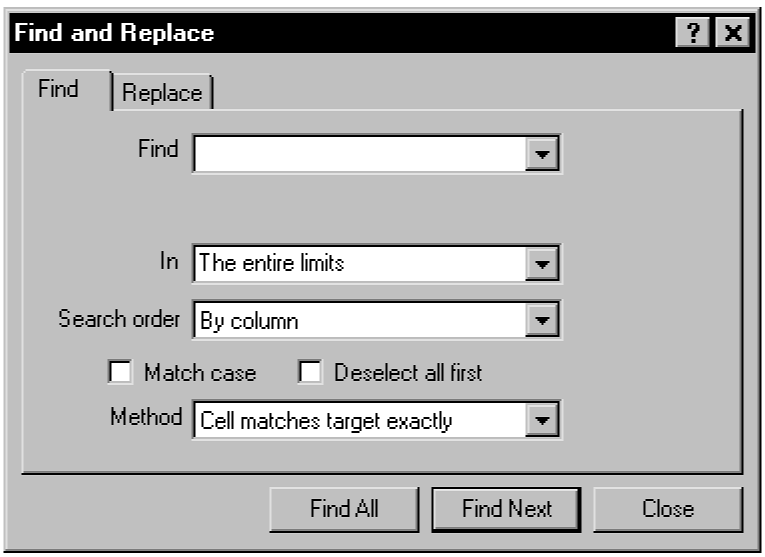
The **Data Tools | Find | Replace** command is used to replace a word or phrase with specified text. The Find and Replace dialog opens to allow entry of the replacement text.

Find and Replace

The **Find and Replace** dialog displays when the Data Tools | Find | Find, Data Tools | Find | Find Next, or Data Tools | Find | Replace commands are clicked. The **Find and Replace** dialog is used to search for and replace specific text in the worksheet.

The Find Page

The **Data Tools | Find | Find** and **Data Tools | Find | Find Next** commands open the **Find** page of the **Find and Replace** dialog.



*Search for and replace specific text in the worksheet with the**Find and Replace**dialog.*

Find

To find a word or phrase, type the text you want to search for in the *Find* field. Click the arrow at the right to select from a list of the most recently used text strings. The asterisk * and question mark ? wildcards can be used in the Find box. Click the arrow at the right to select from a list of the most recently used criteria.

- A question mark ? finds a single character in the specified location. For example, 200? finds 2009, 2008, 200a, etc.
- An asterisk * finds any number of characters at the specified location. For example, *01 finds 601, 1201, c01, etc.

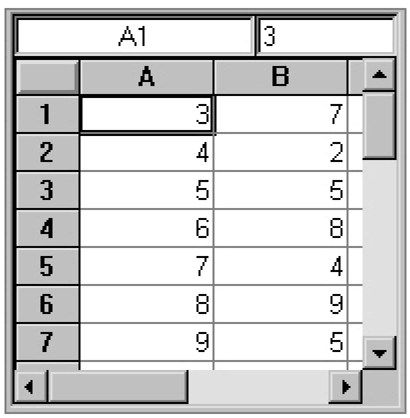
In

Next to *In*, choose the parameters of the search from the list. Choices include *The column where active cell is*, *The row where active cell is*, and *The entire limits*.

- Select *The column where the active cell is* to search only the column (i.e. column B) of the active cell (i.e. cell B2) for the information listed in the Find field.
- Select *The row where active cell is* to search only the row (i.e. row _ 2) of the active cell (i.e. cell B2) for the information listed in the Find field.
- Select *The entire limits* to search the entire worksheet for the information listed in the Find field.

Search Order

The *Search order* controls the direction of the search: down through columns by selecting *By columns* or to the right across rows by selecting *By rows*.



*In this example, cell A1 is selected. If the*Find*criteria is "7", and* By Column*is the*Search order*, cell A5 is found first. If*By row*is the search order, cell B1 is found first.*

Match Case

If you have case sensitive characters in the *Find* text string, check the *Match case* check box. Selecting *Match case* distinguishes between uppercase and lowercase characters. For example, a search for "Elevation" with the Match case option selected will not find entries for "elevation", but will find entries for "Elevation".

Deselect All First

Check the *Deselect all first* box to deselect all selected cells before performing the search. All previously selected cells will be deselected prior to the search when the *Deselect all first* check box is checked. If the *Deslect all first* box is deselected, the results of a previous search will remain highlighted when performing the next search.

Method

Choose the search *Method* from the list to determine how the search is performed.

This examples assume "Golden, CO" is in the *Find* field.

- Select *Cell matches target exactly* to require that the exact criteria in the Search box is present in a cell before it is selected. For example, only cells that have exactly "Golden, CO" will be selected.
- Select *Cell contains target phrase* to require that the phrase in the Search box is present in a cell before it is selected. For example, cells that have "Golden CO", "Golden Company", or "Golden Colorado" will be selected.
- Select *Cell contains all of the target words* to require that all of the Search criteria words are present in a cell before it is selected. For example, cells that have "Golden" and "CO" somewhere in the cell (i.e. "Golden is the best city in Colorado" will be selected).
- Select *Cell contains any of the target words* to require that any of the Search criteria words are present in a cell before it is selected. For example, cells that have "Golden is a city" or "CO is a state" will be selected.

Find All Button

Click the *Find All* button to find all occurrences of the *Find* criteria in the worksheet. All of the cells that contain the *Find* criteria will be highlighted.

Find Next Button

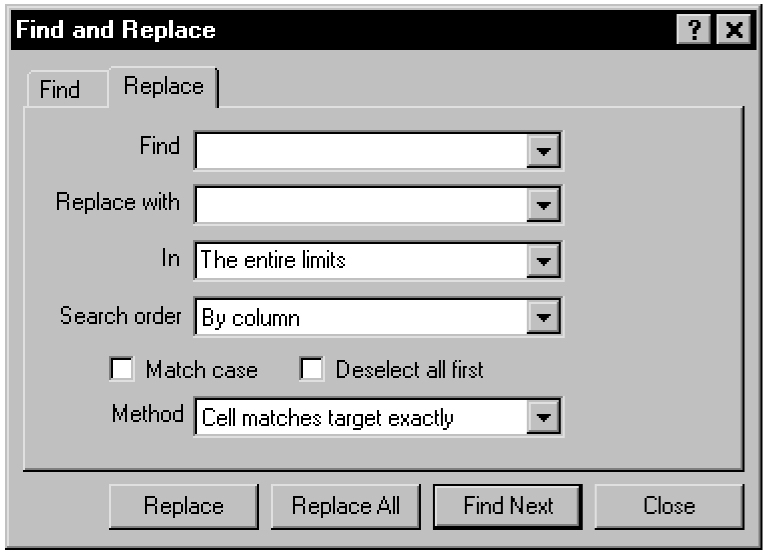
Click the *Find Next* button to find the next occurrence of the characters specified in the *Find* box. This allows you to meet the criteria one at a time. The next instance of the *Find* criteria will be highlighted.

Close Button

Click *Close* to exit the **Find and Replace** dialog.

The Replace Page

The **Data Tools | Find | Replace** command opens the **Replace** page of the **Find and Replace** dialog. The **Replace** page has all of the **Find** page fields, with the addition of the *Replace with* field. The **Replace** page, *Method* field has only two options.



*Replace numbers or text in the worksheet with the**Find and Replace**dialog.*

Replace With

Type the text you want to replace in the *Find* box. To delete the characters in the *Find* box from your worksheet, leave the *Replacewith* box blank. Click the arrow at the right to select from a list of the most recently searched items.

Method

Choose the search *Method* from the list to determine how the search is performed.

The examples assume "Golden, CO" is in the Find field.

- Select Cell matches target exactly to require that the exact criteria in the Search box is present in a cell before it is selected. For example, only cells that have exactly "Golden, CO" will be selected.
- Select Cell matches target exactly to require that the exact criteria in the Search box is present in a cell before it is selected. For example, only cells that have exactly "Golden, CO" will be selected.
- Select Cell contains target phrase to require that the phrase in the Search box is present in a cell before it is selected. For example,

cells that have "Golden CO", "Golden Company", or "Golden Colorado" will be selected.

Replace Button

Click the *Replace* button to replace the selected occurrence of the criteria in the *Find* box with the criteria in the *Replacewith* box, find the next occurrence of the criteria in the *Find* box, and then stop. If you want to automatically replace all occurrences of the search criteria in the worksheet, click the *Replace All* button.

Replace All Button

Click the *Replace All* button to replace all occurrences of the *Find* criteria in your document with the *Replacewith* criteria. If you want to review and selectively replace each occurrence, click the *Replace* button.

Format Cells

Cell numbers, alignment, or background color can be formatted through the **Format Cells** dialog. To format a cell, select the cells to be formatted, then click the **Data Tools | Format | Format Cells** command. The **Format Cells** dialog opens.

The **Format Cells** dialog has three pages: **Number**, **Alignment**, and **Background**.

Number Page

Use the Number page to change the way numeric data is displayed in the worksheet. This includes setting the numeric format for numbers and the date/time entries.

Alignment Page

Use the Alignment page to set the cell alignment.

Background Page

Select cell background color on the Background page.

Text String

Number formatting has no effect on a numeric text string (numbers entered as text). A number with an apostrophe in front of it ('8123) is a text string. The apostrophe only shows in the active cell edit box. For example, an ASCII data file might contain the digits "8123" (digits surrounded by quotes), '8123 (digits preceded with an apostrophe), numbers with letters, or numbers with symbols (e.g. a blackslash "\"). These "numbers" are read as text and not as a number. The Data Tools | Data | Text to Number command can be used to convert numbers preceded by an apostrophe to numeric values, such as with the text '8123. In other cases, the quote marks, letters, or symbols may need to be removed before using the **Text to Number** command.

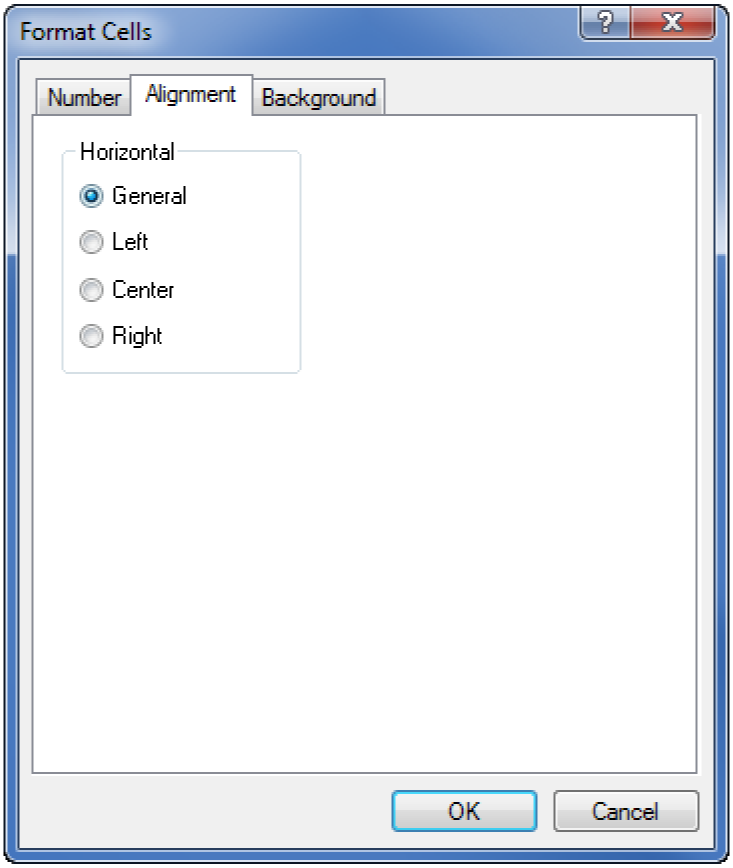
The Data Tools | Data | Transform command can also be used to perform a mathematical function, such as ATOI(X), to convert some text strings to integer values.

Preserve Cell Formatting

The only formats that preserve cell formatting information are the Excel XLS, XLSX or SYLK SLK file formats. ASCII file formats (.CSV, .TXT, .DAT, .BNA, .BLN) do not preserve file format information.

Format Cells - Alignment

Cell numbers, alignment, or background color can be formatted through the **Format Cells** dialog. To format a cell, select the cells to be formatted, then select Data Tools | Format | Format Cells. In the **Format Cells** dialog, click on the **Alignment** tab to align the cell in one of four ways. By default, imported ASCII files automatically align numbers to the right and text to the left.



*Use the **Alignment** page of the **Format Cells** dialog to select the Horizontal alignment of cells.*

General

General aligns text on the left side of the cell and numbers, dates, and times on the right side of the cell.

Left

Left aligns text, numbers, dates, and times on the left side of the cell.

Center

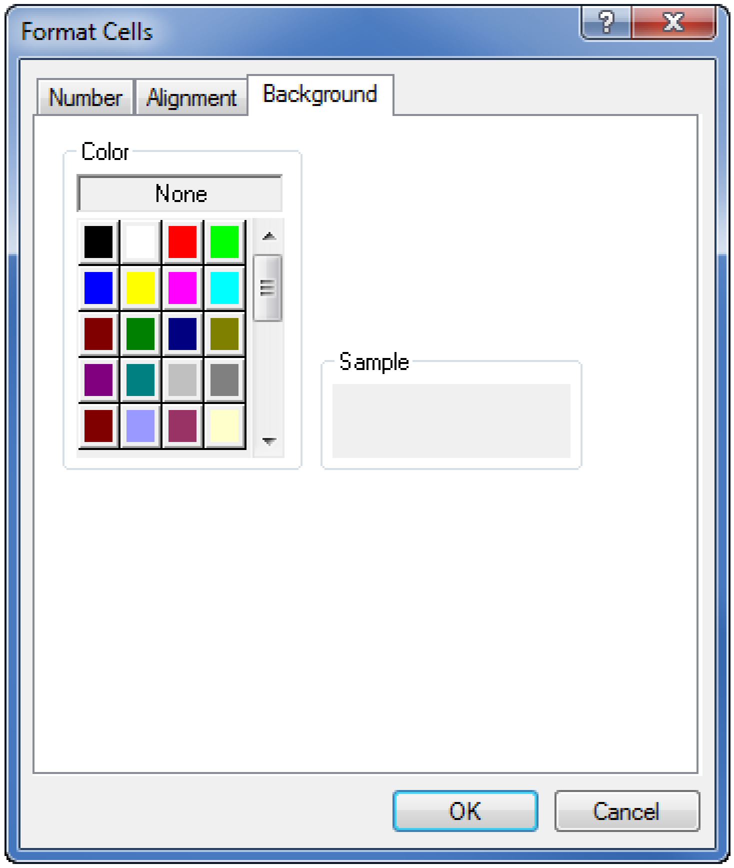
Center aligns text, numbers, dates, and time in the center of the cell.

Right

Right aligns text, numbers, dates, and time on the right side of the cell.

Format Cells - Background

Cell numbers, alignment, or background color can be formatted through the **Format Cells** dialog. To format a cell, select the cells to be formatted, then select Data Tools | Format | Format Cells. You can set cell background color on the **Background** page. Save the worksheet in Excel format to save background color in the file.



Select the cell background color the ***Background*** *page of the* ***Format Cells*** *dialog.*

None
Click the *None* button to remove any previously assigned background colors.

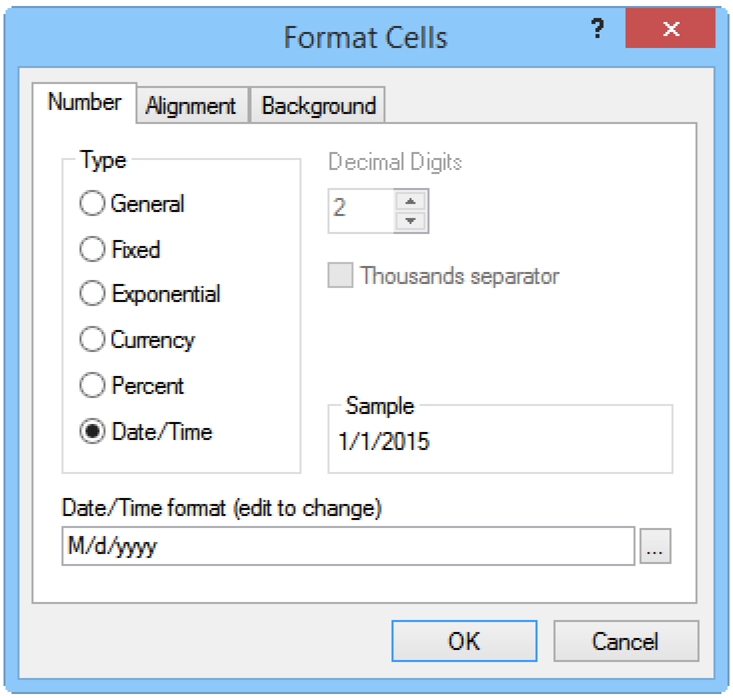
Color Palette
Select a cell background color from the color palette.

Sample
A sample of the color is displayed in the *Sample* box.

Format Cells - Number

Cell numbers, alignment, or background color can be formatted through the **Format Cells** dialog. To format a cell, select the cells to be formatted, then select Data Tools | Format | Format Cells. Use the **Number** page to change the numeric data display in the worksheet. This includes setting the numeric format for numbers and the date/time entries.

Number formatting has no effect on a numeric text string (numbers entered as text). For example, an ASCII data file might contain the numbers '8123 (numbers preceded by single quote) which are read as text and not as a number. The Data Tools | Data | Text to Number command can be used to convert numbers stored as text to numeric values.



*Use the **Number** page to change the numeric data display in the worksheet.*

Type

The *Type* section contains the numeric format for the selected cells. Available options are *General, Fixed, Exponential, Currency, Percent,* and *Date/Time*. Click on the desired option.

- *General* displays numbers as fixed or exponential, whichever is shorter.
- *Fixed* displays numbers as d.ddd. The number to the left of the decimal can vary. Set the number to the right of the decimal in the

Decimal Digits box.

- *Exponential* displays numbers as d.ddde+dd. Set the number of digits to the right of the decimal in the *Decimal Digits* box.
- *Currency* displays fixed numbers with a currency symbol such as the dollar sign ($).
- *Percent* displays numeric values (such as 0.13) as percentages with a percent symbol suffix (13%).
- *Date/Time* formats the cells as dates and/or time. Select *Date/Time* and then either type the desired *Date/Time format* or click the button to create the desired date/time format in the Date/Time Format Builder dialog.

Decimal Digits

The *Decimal Digits* controls the number of digits to the right of the decimal when the *Type* is set to *Fixed, Exponential, Currency,* or *Percent*. To change the *Decimal Digits*, highlight the existing value and type a new value. Alternatively, click the to increase or decrease the value.

Thousands Separator

The *Thousands separator* option controls whether a comma appears in the number, indicating thousands. When checked, a comma appears every three digits to the left of the decimal point. When unchecked, the number appears without the comma. Do not type a comma when entering data as this causes the number to be read as text.

If the Options dialog *Decimal separator* is set to *Comma*, or *System default* when comma is the system default, a period (.) will be displayed for the *Thousands separator*.

Sample

The *Sample* box displays the current number format.

OK or Cancel

Click *OK* to make the change to the cell format. Click *Cancel* to return to the worksheet without making the change.

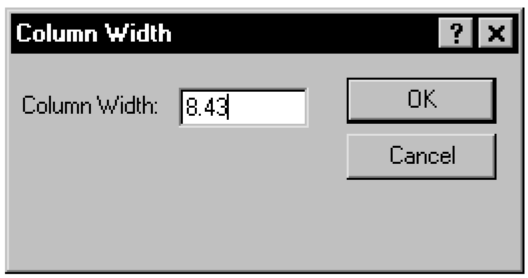
Column Width

You can change the column width of selected cells by clicking the **Data Tools | Format | Column Width** command or by using the mouse to resize the column. You can double-click the column line to automatically set the column width, or you can manually change the column width by clicking and dragging the column header dividing line. When automatically setting the column width, the column narrows or widens to the smallest size necessary to completely display the data.

The Excel XLS, Excel XLSX, or SYLK SLK file format must be used to save the column width in the file since ASCII file formats (.CSV, .TXT, .DAT, .BNA, .BLN) do not preserve file format information.

Column Width Dialog

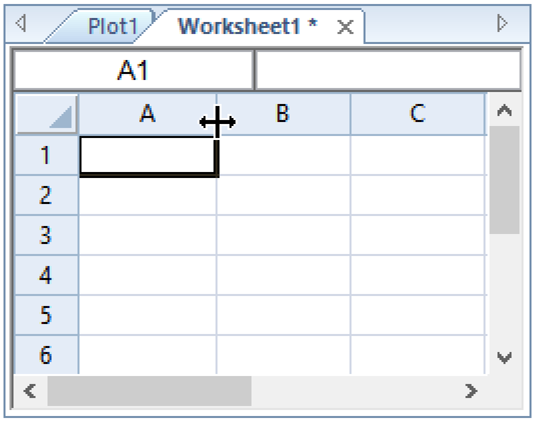
To set column widths or to hide columns, select the entire column or individual cells within the columns, and then select **Data Tools | Format | Column Width**. Enter the width for the selected column or cells into the **Column Width** dialog. Columns can range from zero to 512 characters wide.



*Change the column width by selecting columns, clicking the **Column Width** command, and then entering a number into the**Column Width**dialog.*

Changing Column Widths with the Mouse

Column width can also be changed using the mouse. When the cursor is moved to the line that defines the right boundary of the column header, the cursor changes to a line with two arrows. Press and hold the left mouse button and move the cursor to the left or right to change the width of the column.



This example shows the cursor being used to change the width of column A.

Hide a Column

You can hide a column by moving the cursor to the left until the next dividing line is reached. In the **Column Width** dialog, a *Column Width* value of zero (0) hides the column.

Display Hidden Columns

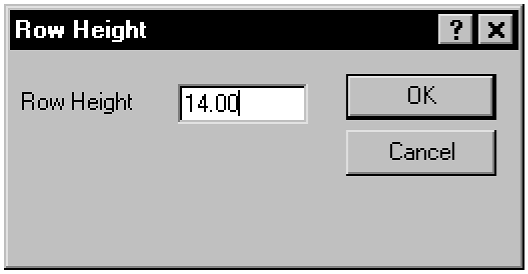
To display hidden columns, press and hold the left mouse button at the right edge of the hidden column and move the cursor to the right to widen the column.

Row Height

You can change the row height of selected cells by choosing **Data Tools | Format | Row Height** or by using the mouse to size the row. The Excel XLS, Excel XLSX, or SYLK SLK file format must be used to save the row height and numeric format information with the file since ASCII file formats (.CSV, .TXT, .DAT, .BNA, .BLN) do not preserve file format information.

Row Height Dialog

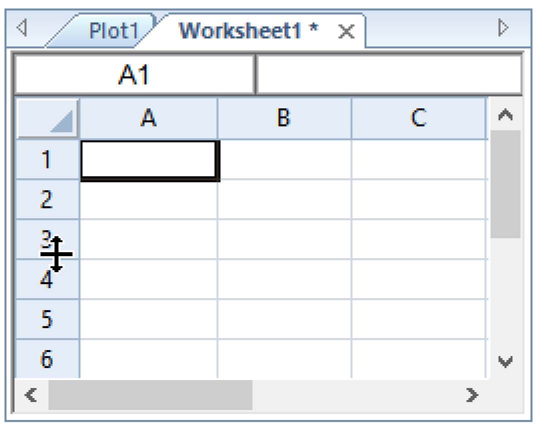
To set row heights or to hide rows, select the entire row or individual cells within the rows, and then select **Data Tools | Format | Row Height**. Enter the width for the selected row or cells in the **Row Height** dialog. Rows can range from zero to 512 characters in height.



*Change the row height by selecting rows, clicking the **Row Height** command, and then entering a number into the**Row Height**dialog.*

Changing Row Heights with the Mouse

Row height can also be changed using the mouse. When the cursor is moved to the line that defines the lower boundary of the row header, the cursor changes to a line with two arrows . Press and hold the left mouse button, move the cursor up or down to change the height of the row.



This example shows the cursor being used to change the height of row 3.

Hide a Row

You can hide a row by moving the cursor up until the next dividing line is reached. In the **Row Height** dialog, a *Row Height* value of zero (0) hides the row.

Display Hidden Rows

To display hidden rows, press and hold the left mouse button at the bottom of the hidden row and move the cursor down to stretch the row height.

Hiding Columns or Rows

The mouse may be used to hide columns or rows.

To hide a column, first click on the vertical dividing line to the right of the column. Drag the vertical dividing line to the left as far as it will go and then release the mouse button. If there are hidden columns to the right of this column, grab the left side of the vertical dividing line. If the right side of the vertical dividing line is selected, the vertical dividing line for the adjacent hidden column is selected.

To hide a row, first click on the horizontal dividing line at the bottom of the row. Drag the horizontal dividing line up as far as it will go and then release the mouse button. If there are hidden rows above this row, grab horizontal dividing line just below the line. If the top side of the horizontal dividing line is selected, the horizontal dividing line for the adjacent hidden row is selected.

With the Data Tools Tab Commands

Columns and rows can also be hidden with the Data Tools | Format | Column Width and Data Tools | Format | Row Height commands. Select the columns or rows to hide, select **Data Tools | Format | Column Width** or **Data Tools | Format | Row Height**, and then set the *Column Width* or *Row Height* to zero.

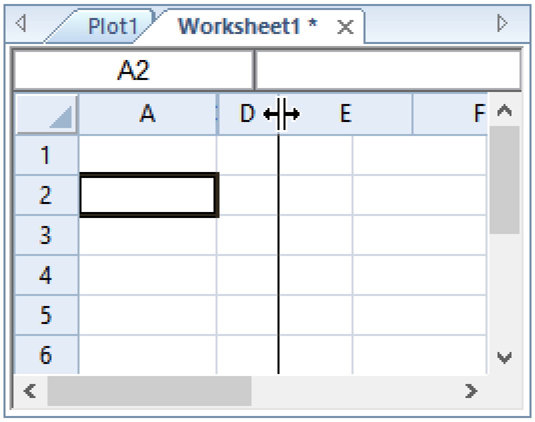
Displaying Hidden Columns or Rows

The mouse may be used to display hidden columns or rows.

To display a hidden column, first click on the vertical dividing line to the right of the hidden column and then drag the vertical dividing line to the new position. If several adjacent columns are hidden, only the far right column is displayed after the dividing line is dragged. If the cursor is to the left of the vertical dividing line when the line is selected, then the selected vertical dividing line is for the visible column to the left and not for the hidden column.

To display a hidden row, first click on the horizontal dividing line below the hidden row and then drag the horizontal dividing line to the new position. If several adjacent rows are hidden, only the bottom row is displayed after dragging the dividing line. If the cursor is above the horizontal dividing line when the line is selected, then the horizontal dividing line is for the visible row above the hidden rows, and not for the hidden rows.

Example
If columns B, C, and D are hidden and columns A and E are visible, then one vertical dividing line appears between columns A and E. Select that vertical dividing line with the cursor slightly to the right of the dividing line. This selects the line for column D. (If the cursor is to the left of the dividing line, then the dividing line for column A is selected.) Drag the vertical dividing line to the right to display column D. Repeat for columns C and B.

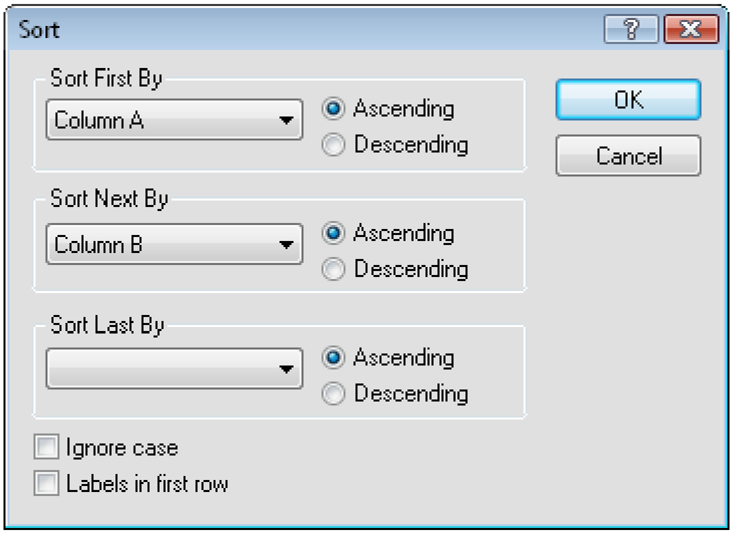


This example shows the vertical line being dragged to display hidden column D.

With the Data Tools Tab Commands
Hidden columns and rows can also be displayed with the Column Width and Row Height commands. To display hidden rows or columns, select the columns or rows on both sides of the hidden columns or rows, click **Data Tools | Format | Column Width** or **Data Tools | Format | Row Height**, and then set the *Column Width* or *Row Height* to a number greater than zero.

Sort - Worksheet

Click the **Data Tools | Data | Sort** command to arrange data according to rank in user-specified sort columns. Sorting rank is based on numbers, ASCII characters, and punctuation. You can sort numeric data, text, or mixed columns.



*Use the **Data Tools | Data | Sort** command to sort data on multiple columns.*

Selecting Cells to Sort

Sorting is performed only on the selected columns. If only one column is selected, only that column is sorted. To keep records (rows of data) together, select all columns containing data even if only one column is sorted. To decrease sort time, select a block of cells rather than clicking on the row or column labels.

Sort Order

The *Sort First By* option defines the primary column on which the rows are sorted. The positions of the sorted rows are determined by the *Ascending* or *Descending* rank in the *Sort First By* column.

Secondary Sort

When two or more rows have identical entries in the *Sort First By* column, the *Sort Next By* column can further organize the data set. Duplicates in the *Sort First By* column are then sorted according to the rank in the *Sort Next By* column.

Final Sort

The *Sort Last By* column can be used when the *Sort Next By* column contains duplicates.

Ascending or Descending Sort

The sort order in an *Ascending* sort is based on the ASCII table. Numeric values are placed first, followed in order by cells starting with a space character, common punctuation, numeric text (numbers entered as text), uppercase letters, less common punctuation, lower case letters, uncommon punctuation, and blank cells. Descending order is the opposite of ascending order although blank cells are still listed last.

0	1	2	3	4	5	6	7	8	9
space	!	"	#	$	%	&	'	(	)
*	+	,	-	.	/	"0"	"1"	"2"	"3"
"4"	"5"	"6"	"7"	"8"	"9"	:	;	<	=
>	?	@	A	B	C	D	E	F	G
H	I	J	K	L	M	N	O	P	Q
R	S	T	U	V	W	X	Y	Z	[
\	]	^	_	`	a	b	c	d	e
f	g	h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y
z	{	|	}	~	blank				

This ASCII table shows the sort order in the worksheet.

Ignore Case

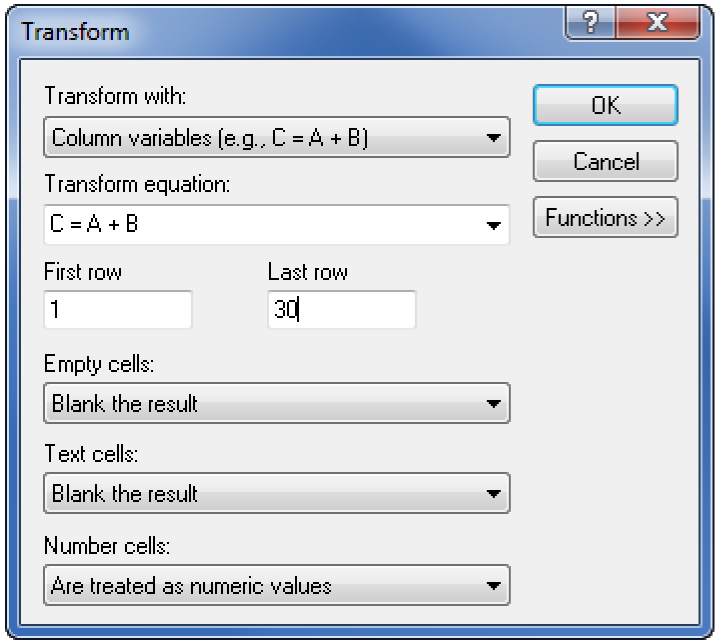
Because sorting is based on an ASCII table, upper and lowercase letters are treated differently. For example, "A" is sorted separately from "a." If the letters are to be treated as the same during the sort, check the *Ignore case* option. When this check box is activated, "A" is considered identical to "a" in the sorting rank.

Labels in First Row

The data set may contain text identifying the data in the column (header information) in Row 1. In this case, click the *Labels in first row* option to exclude the label row from the sort process.

Transform - Worksheet

Click the **Data Tools | Data | Transform** command to open the **Transform** dialog, where you can apply mathematical transformations to columns, rows, or cells. Valid math operators include addition (+), subtraction (-), multiplication (*), and division (/) as well as a large library of built-in mathematical functions. Parentheses should be used to override precedence or for clarification.



*Use the **Transform** dialog to apply math functions to data. The dialog options update to reflect the option selected for* Transform with *field.*

Transform With

Select the type of transform from the *Transform with* list.

- *Column variables (e.g., C = A + B)* applies the transform equation to the specified rows in the *Transform equation* column.
- *Row variables (i.e., _3 = _1 + _2)* applies the transform equation to the specified columns in the *Transform equation* row.
- *Cell variables (i.e., C3 = A1 + B2)* applies the transform equation to the cell specified in the *Transform equation*. Multiple cells can be transformed by selecting the *Relative cell references* option.

Transform Equation

Type the formula into the *Transform equation* box. Formulas consist of a destination column, row, or cell on the left side of the equation and a mathematical manipulation on the right side of the equation. Use the column label letters, row numbers, or cell locations on both sides of the equation. Click the down arrow to use previously entered equations. For columns, a sample equation may be C = A + B. For rows, a sample equation is _4=_1+_2. For cells, a sample equation would look like C2=A1+B1-C1.

If the transform method is by column, the range functions (sum, avg, std, rowmin and rowmax) take column indices only, i.e., sum(A...C). If transform method is by variable rows, the range functions take row indices only, i.e., sum(_1..._3). If transform method is by variable cells, the range functions are not supported.

The last ten functions are stored in the *Transform equation* field. After ten functions are included in the list, the oldest function is replaced when a new function is added. The *Transform equations* are stored between sessions. To use a stored function, click the in the *Transform equation* box and select a function from the list. Note that the *First row* and *Last row* or *First col* and *Last col* values are not saved with the stored *Transform equations*.

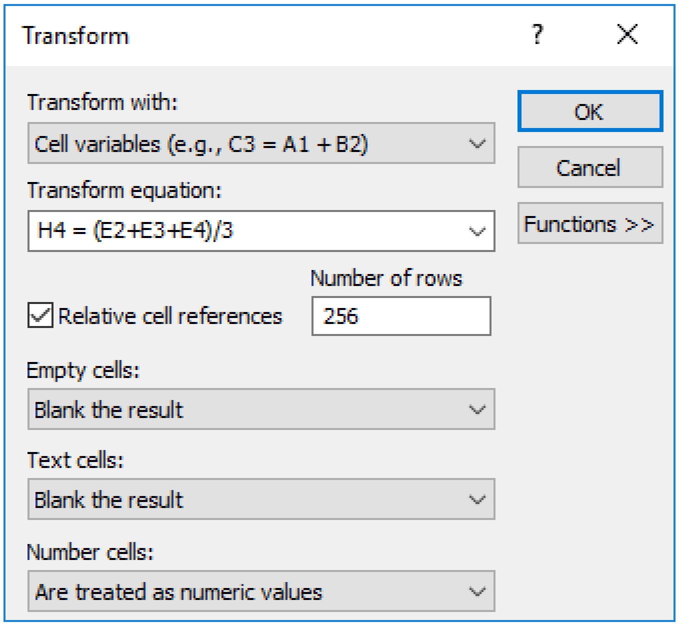
First and Last Columns and Rows

When calculating transformations on columns, enter the *First row* and the *Last row* to limit the calculation to the specified rows. When calculating transformations on rows, enter the *First col* and *Last col* to limit the calculation to the specified columns. When calculating transformations on cells, the *First row, Last row, First col,* and *Last col* options are not available.

By default, these are set to the first row and last row (or first column and last column) with text or numbers entered into a cell for the entire worksheet.

Relative Cell References

Select the *Relative cell references* option to apply the *Transform equation* to multiple cells. The *Relative cell references* option is only available when *Transform with* is set to *Cell variables (e.g., C3 = A1 + B2)*. The *Transform equation* is only applied relatively by incrementing the row numbers. The columns do not change when *Relative cell references* is selected.



The Relative cell references *option applies the* Transform equation *to multiple rows.*

Specify the number of rows to which the *Transform equation* is applied in the *Number of rows* field. Note this value is not the row number. For example in the image above, the *Transform equation* starts at cell H4 with the equation H4 = (E2+E3+E4)/3 and transforms a total of 256 rows, ending at cell H259. By default the *Number of rows* value is the total number of rows in the worksheet.

Empty Cells

The *Empty cells* option controls how empty cells are treated in the calculations of formulas. Available options are *Blank the result, Are treated as the number zero (0),* and *Are treated as empty text ("").* The default option is *Blank the result*, which results in the formula not being calculated for any row that contains a blank cell in any of transform equation rows or columns.

- Setting the *Empty cells* option to *Blank the result* results in a blank cell for the transform when the cells on the right side of the equation are empty.
- Setting the *Empty cells* option to *Are treated as the number zero (0)* results in the transform creating a number when all of the cells on the right side of the equation are empty or numeric. When the right side of the equation combines text and blank cells, the equation is blank.
- Setting the *Empty cells* option to *Are treated as empty text ("")* results in the transform creating a text string when all of the cells on

the right side of the equation are empty or text. When the right side of the equation combines numeric and blank cells, the equation is blank.

Text Cells

The *Text cells* option controls how text cells are treated in the calculations of formulas. Available options are *Blank the result, Are treated as text, Are converted to numbers (if possible),* and *Are treated as the number zero (0).* The default option is *Blank the result*, which results in the formula not being calculated for any row that contains a text cell in any of transform equation rows or columns.

- Setting the *Text cells* option to *Blank the result* results in a blank cell for the transform when any of the cells on the right side of the equation contain text strings (including numbers formatted as text).
- Setting the *Text cells* option to *Are treated as text* results in the transform creating a text string when all of the cells on the right side of the equation are text (or treated as text). If a mix of text cells and numbers or empty cells (that are not treated as text) are in the cells on the right side of the equation, the transform results in a blank cell. This option allows text strings to be concatenated.
- Setting the *Text cells* option to *Are converted to numbers (if possible)* results in the transform creating a number when all of the cells on the right side of the equation are numeric or treated as numbers. Any cells with numbers formatted as text are treated as the number. For example, the text string '05 would be treated as the number 5 if this option is selected.
- Setting the *Text cells* option to *Are treated as the number zero (0)* results in the transform creating a number when all of the cells on the right side of the equation are numeric or treated as numbers. Any cells with text are replaced with the value zero for the transform. For example, if you are using the equation C=A+B and A has *Colorado* and B has *45*, the value in cell C will be 45.

Number Cells

The *Number cells* option controls how numeric cells are treated in the calculations of formulas. Available options are *Blank the result, Are treated as numeric values, Are converted to text,* and *Are treated as empty text ("").* The default option is *Are treated as numeric values*, which results in the formula being calculated for any row that contains numbers in any of transform equation rows or columns.

- Setting the *Number cells* option to *Blank the result* results in a blank cell for the transform when any of the cells on the right side of the equation contain numbers. This option is useful when you only want to combine text cells or blank cells.

- Setting the *Number cells* option to *Are treated as numeric values* results in the transform creating a number when all of the cells on the right side of the equation are number (or treated as numbers). If a mix of text cells and numbers or empty cells (that are not treated as numbers) are in the cells on the right side of the equation, the transform results in a blank cell.
- Setting the *Number cells* option to *Are converted to text* results in the transform creating a text string when all of the cells on the right side of the equation are text or treated as text. Any cells with numbers are treated as the text string of the number. For example, number 5 is in the cell, so the text string would appear as '5 if this option is selected.
- Setting the *Number cells* option to *Are treated as empty text ("")* results in the transform creating a text string when all of the cells on the right side of the equation are text or treated as text. Any cells with numbers are replaced with "" for the transform. For example, if you are using the equation C=A+B and A has *Colorado* and B has *45*, the value in cell C will be *Colorado*.

Combining Text, Numbers, and Empty Cells

Many possible combinations of the *Empty cells, Text cells,* and *Number cells* exist to allow combining these different types of cells in a *Transform equation*. If the transform result is not what you expect, check the settings for these options and adjust if necessary.

Functions

Click the *Functions* >> button to open a list of predefined mathematical functions. Click the *Functions* << button to hide the list of predefined mathematical functions.

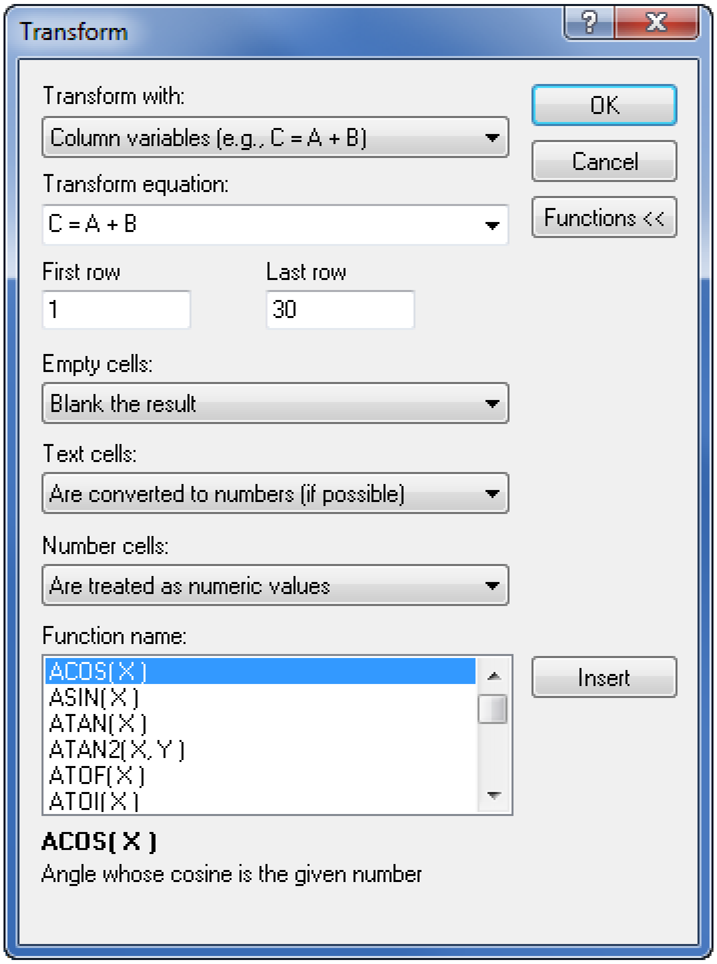
To use a function, place the cursor in the location to add a function, select a function from the list, click the *Insert* button, and then replace the X in the function with a column letter (A), row number (_1), or cell location (A1). Also, be sure to use proper mathematical operators (+_*/) between the function and the rest of the equation. The definition of the function is listed below the *Function name* list when a function is selected.

Row or column range functions, for example SUM(A..Z), cannot be used with a cell variable *Transform equation*.

Insert

When the *Functions* are expanded, the *Insert* button is visible. Select a function and click the *Insert* button to add a function to the equation.

Change the variable (i.e. X) in the listed functions to a column letter, row number (_1), or cell location in the transformation equation.



This example used the Functions *button to choose a predefined function from the* Function name *list. The* Insert *button was used to add the selected function to the* Transform equation *box. The values were changed to fit the desired column variables.*

Errors

Any calculations that result in error values are listed in the Transform Errors dialog. The most common error is "floating point divide by zero."

Examples

An example of a column formula is C = A + B. Columns A and B are added and inserted into column C with this equation. The formula adds the contents of A and B in each row and places the results in column C for that row.

An example of a row formula is _4=_1+_2. Rows 1 and 2 are added and inserted into row 4 with this equation. The formula adds the contents of the 1 and 2 in each column listed between the *First col* and *Last col* values and places the results in row 4 for that column.

An example of a cell formula is C2=A1+B1-C1. The value in C1 is subtracted from the sum of the values in cells A1 and B1. The result is inserted into cell C2 with this equation.

Example Functions

This example shows how to use the built in functions. Consider, for example, taking the cosine of data in column C. Column D is the first empty column, so we will use column D as the destination column.

1. Click the **Data Tools | Data | Transform** command to open the **Transform** dialog. You do not need to highlight any columns before selecting **Transform**.
2. In the *Transform equation* box, type "D = " without the quotes.
3. Click the *Functions* button.
4. Double-click on the function name COS(X) in the *Function name* group. Alternatively, you could select a *Function name* and click the *Insert* button.
5. COS(X) is automatically placed in the equation as "D = COS(X)" without the quotes.
6. Replace the X in the function with the column letter containing the data to be transformed (column C). The equation will be "D = COS (C)" without the quotes.
7. Change the *First row* and *Last row* if you wish.
8. Make sure that *Empty cells* and *Text cells* are set to *Blank the result* to only calculate values with numbers.
9. Click *OK* to create a new data column with column C's data transformed with the cosine.

Mathematical Functions

Mathematical Functions are used to modify data with the Data Tools | Data | Transform command in the worksheet or create function plots in the plot window.

Data Types

The expression evaluator supports 32-bit signed integer numbers, double-precision floating-point numbers, a Boolean value, a text string of 0 to 256 characters, and time stamp values.

Variable Names

Variable names must begin with a column letter (i.e. A), row number (i.e. _1), or cell location (i.e. A2), which may be followed by other letters, numbers, or underscores (_), up to a maximum of 256 characters per variable name.

The variable names are not case sensitive. For example, **sum(a..z)**, **sum (A..z)**, and **sum(A..Z)** all refer to the same variable.

Precedence

The mathematical expression can consist of constants, variables (such as column letters), or functions (outlined below). The formulas follow standard precedence rules. Spaces are used in the equation for clarity.

Operators of equal precedence are evaluated from left to right within the equation. Parentheses are used to override precedence, and expressions within parentheses are performed first.

Operators, in order of decreasing precedence are:

( )	parentheses
-	minus (or negative sign)
^	exponentiation (raise-to-the-power-of)
* /	multiplication and division
+ -	addition and subtraction

The expression evaluator treats operators with the following precedence:

1. !, NOT, ~
2. ^, POW
3. *, /, %
4. +, -
5. <<, >>
6. <, >, <=, >=
7. ==,!=,<>
8. &
9. XOR
10. |
11. &&, AND
12. ||, OR
13. ?:
14. IF

Built-in Functions

The following built-in functions are supported:

Trigonometric Functions

All trigonometric functions are carried out in radians. If the data are in degrees, use the d2r(x) conversion function (in the *Miscellaneous Functions* section below) to convert degree data to radians and then use the trigonometric functions.

sin(x)	sine of angle x
cos (x)	cosine of angle x
tan (x)	tangent of angle x, the value of x must not be an odd multiple of Π/2.
asin (x)	Arcsine in the range -Π /2 to Π/2, x must be between -1 and 1
acos (x)	Arccosine in the range 0 to Π, x must be between -1 and 1
atan (x)	Arctangent in the range -Π/2 to Π/2
atan2 (y,x)	Arctangent in the range -Π to Π

Bessel Functions

j0(x) j1(x) jn (n,x)	Bessel functions of the first kind at x of orders 0, 1, and n, respectively
y0 (x) y1 (x) yn (n,x)	Return the Bessel functions of the second kind at x, of orders 0, 1, and n, respectively. For y0, y1, and yn, the value of x must not be negative.

Exponential Functions

exp(x)	exponential function of x (e to the x)
sinh(x)	hyperbolic sine of angle x
cosh(x)	hyperbolic cosine of angle x
tanh(x)	hyperbolic tangent of angle x
ln(x)	natural logarithm of x, x must be positive
log10(x)	base 10 logarithm of x, x must be positive

pow(x,y)	x raised to the y^{th} power Alternatively use x^y Error conditions result if x is zero and y is negative or zero, x is negative and y is not an integer, an overflow results.

Miscellaneous Functions

min(x,y)	smaller of x and y
max(x,y)	larger of x and y
randn(x,y)	an approximately normally (Gaussian) distributed real random number with mean x and standard deviation y
randu(x)	a uniformly distributed real random number from the interval [0,x]
row()	row number
ceil(x)	smallest integer that is greater than or equal to x
floor(x)	largest integer less than or equal to x
pi()	returns the value of Pi. To limit to a specific number of digits, use Round(Pi(),y) where Y is the number of digits after the decimal point
round(x,y)	X rounded to the nearest number with Y digits after the decimal point
sign(x)	Evaluates the sign of x. Returns -1 when x < 0, returns 0 when x = 0, returns 1 when x > 0
sqrt(x)	square root of x, x must not be negative
fabs(x)	absolute value of x
fmod(x,y)	floating point remainder of x/y, if y is zero, fmod returns zero
d2r(x)	convert argument in degrees to radians, for example: sin(d2r(30)) computes the sine of 30 degrees, sin(30) computes the sine of 30 radians
r2d(x)	convert argument in radians to degrees

Statistical Functions of an Interval

sum(a..z)	calculates the sum of a range of columns in a row
sum(_1.._5)	calculates the sum of a range of rows in a column
avg(a..z)	calculates the average of a range of columns in a row

avg(_1.._5)	calculates the average of a range of rows in a column
std(a..z)	calculates the (population) standard deviation of a range of columns in a row
std(_1.._5)	calculates the (population) standard deviation of a range of rows in a column
rowmin(a..z)	finds the minimum value of a range of columns in a row
rowmin(_1.._5)	finds the minimum value of a range of rows in a column
rowmax(a..z)	finds the maximum value of a range of columns in a row
rowmax(_1.._5)	finds the maximum value of a range of rows in a column

The statistical functions of an interval of columns operate row-wise on an interval of columns. For example, SUM(A..Z) computes the sum of the twenty-six columns A, B, C, ..., Z separately for each row. You can replace A..Z with any valid interval of columns, e.g., C..H or W..AC. There must be exactly two periods between the column labels. Columns may be given in reverse order, i.e., SUM(Z..A).

The statistical functions of an interval of rows operate column-wise on an interval of rows. For example, SUM(_1.._5) computes the sum of the 5 rows 1, 2, 3, 4, 5 separately for each column. You can replace _1.._5 with any valid interval of rows, e.g., _3.._12 or _34.._413. There must be exactly two periods between the row labels. Rows may be given in reverse order, i.e., SUM(_5.._1).

String Comparison

atof(x)	converts string to floating-point number
atoi(x)	convert a string x to an integer value
ftoa(x,y)	convert a floating-point number x to a string with y digits after the decimal
strlen(x)	length of string x in characters
strcmp(x,y)	compare string x with y and return 1 if x>y, -1 if x<y, or 0 if x=y
stricmp(x,y)	compare string x with y without regard to the case of any letters in the strings
strncmp (x,y,z)	compare the first z character of string x with y
strnicmp (x,y,z)	compare the first z characters of string x with y without regard to the case of any letters in the strings

String comparison functions work with strings, not numbers. Any rows or columns containing numbers result in blanks. In each of the string comparison functions, 1 is returned if string x is greater than string y, -1 is returned if string x is less than string y, and 0 if string x = string y. In the three-parameter comparison functions, the third parameter, z, specifies the number of characters to compare. For example, a z value of 3 compares the x and y strings' first three characters and ignores any characters after the third.

The comparisons are based on the standard ASCII table:

1. numeric values (disregarded in string comparisons as mentioned above)
2. cells starting with a space character
3. common punctuation
4. numeric text (numbers entered as text)
5. less common punctuation
6. uppercase letters
7. even less common punctuation
8. lower case letters
9. uncommon punctuation
10. blank cells (disregarded in string comparisons)

0	1	2	3	4	5	6	7	8	9
space	!	"	#	$	%	&	'	(	)
*	+	,	-	.	/	"0"	"1"	"2"	"3"
"4"	"5"	"6"	"7"	"8"	"9"	:	;	<	=
>	?	@	A	B	C	D	E	F	G
H	I	J	K	L	M	N	O	P	Q
R	S	T	U	V	W	X	Y	Z	[
\	]	^	_	`	a	b	c	d	e
f	g	h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y
z	{	|	}	~	blank				

This is the ASCII table order. The table is read left to right, top to bottom. Items appearing toward the upper left corner are less than the items appearing toward the lower left corner.

Boolean Expressions

Boolean expressions, include:

- **logical operators** (and, or, xor, not)
- **comparison operators** (=, <>, <, >, <=, >=)

- the **IF function**, i.e., IF(condition,true_value,false_value)

The words AND, OR, XOR, NOT, and IF are reserved keywords and may not be used as variable names.

Logical Operators (and, or, xor, not)

<table>
<tr><th>SYMBOL</th><th>NAME</th><th>DESCRIPTION</th></tr>
<tr><td>AND</td><td>AND</td><td>The result is true if both operands are true</td></tr>
<tr><td>&&</td><td>AND</td><td>The result is true if both operands are true</td></tr>
<tr><td>!</td><td>Logical NOT</td><td>Inverts the Boolean value. True becomes false, false becomes true</td></tr>
<tr><td>NOT</td><td>Logical NOT</td><td>Inverts the Boolean value. True becomes false, false becomes true</td></tr>
<tr><td>&</td><td>AND</td><td>The result is true if both operands are true</td></tr>
<tr><td>|</td><td>OR</td><td>The result is true if either of the two operands are true</td></tr>
<tr><td>XOR</td><td>Exclusive-OR (XOR)</td><td>The result is true only when the two operands are different</td></tr>
<tr><td>||</td><td>OR</td><td>The result is true if either of the two operands are true</td></tr>
<tr><td>OR</td><td>OR</td><td>The result is true if either of the two operands are true</td></tr>
</table>

Comparison Operators (=, <>, <, >, <=, >=)

SYMBOL	NAME	DESCRIPTION
~	Bitwise NOT	Inverts the bits in an integer
*	Multiple	Multiplies the two operands
/	Divide	Divides the first operand by the second
%	Remainder	Integer remainder of the first operand divided by the second
+	Add	Adds the two operands
-	Subtract	Subtracts the second operand from the first
<<	Shift Left	Shifts the operand to the left
>>	Shift Right	Shifts the operand to the right
<	Less Than	Result is true if the value of p1 is less than the value of p2

<=	Less Than or Equal To	Result is true if the ordinal value of p1 is less than or equal to p2
>	Greater Than	Result is true if the ordinal value of p1 is greater than p2
>=	Greater Than or Equal To	Result is true if the ordinal value of p1 is greater than or equal to p2
==	Equal To	Result is true if the operands have identical values
!=	Not Equal To	Result is true if the operands do not have identical values
<>	Not Equal To	Result is true if the operands do not have identical values

IF Function IF(condition, true_value, false_value)

SYMBOL	NAME	EXAMPLE	DESCRIPTION
IF	Conditional Evaluation	IF (p1,p2,p3)	IF(condition,true_value,-false_value) If p1 is true, the result will be p2. If p1 is false, the result will be p3
IF	Conditional Evaluation	p1?p2:p3	condition?true_value:false_value If p1 is true, the result will be p2. If p1 is false, the result will be p3

Examples

The following are examples of mathematical function syntax. If you use Transform in the worksheet, replace X, Y, and Z with column letters (A is column A), row numbers (_1 is row 1), or cell locations (A1).

Equation	Mathematical Function Syntax
x^2	x^2 OR pow(x,2)
$\ln(x)$	ln(x)
$\log_{10} x$	log10(x)
$1-e^{-x}$	(1-exp(-X))
$1-e^{-x^2}$	1-exp(-x^2)
$1-\frac{\sin(x)}{x}$	1-(sin(x)/x)

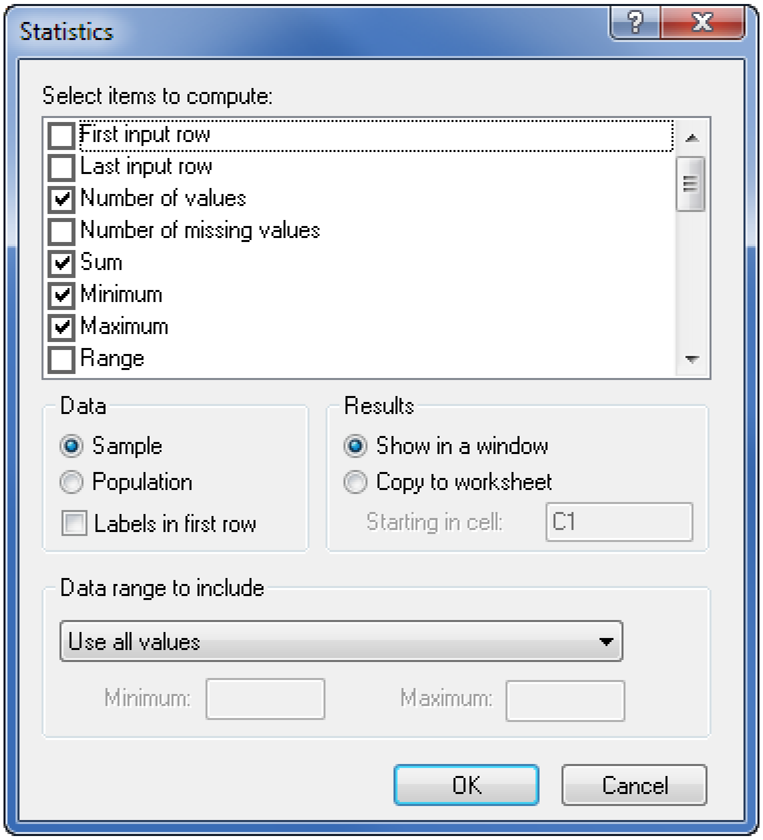
$\frac{x^2}{1+x^2}$	x^2/(1+x^2)
$2x-x^2$	(2 * X)-pow(x,2)
$(x^2+y^2)(\sin(8\times\tan^{-1}xy))$	(pow(x,2)+pow(y,2))*(sin(8*atan (x*y)))

Statistics - Worksheet

The **Data Tools | Data | Statistics** command calculates statistical values for a group of selected numeric cells (see *Selecting Worksheet Cells*). Select an entire column or a continuous group of cells in a column to use the **Statistics** command. If a rectangular block of rows and columns are selected, the **Statistics** command calculates the statistics for each column separately. A warning message appears if a group of cells cannot be used with the **Statistics** command. Non-numeric cell entries (empty cells or text) are ignored in statistics calculations.

Statistics Dialog

Click the **Data Tools | Data | Statistics** command in the worksheet to open the **Statistics** dialog.



Click in the box adjacent to the statistics name to compute the statistics for the selected column.

Select Items to Compute

The *Select items to compute* list contains a list of statistics to choose from. Multiple statistics can be chosen.

- *First input row* reports the first row number in the selection. If the *Labels in first row* option is checked, the *First input row* is the second row in the selection.
- *Last input row* reports the last row number containing data in the column.
- *Number of values* indicates the number of numeric cells in the column.
- *Number of missing values* indicates the number of non-numeric cells in the selection. If columns are selected by clicking the column letters, the number of missing values includes blank values up to the last used row in the worksheet, which may be different from the last used row in the selected column. If cells are selected by highlighting specific cells, then only the blank cells within the selection are counted.
- *Sum* is the sum of all numeric cells in the column.

- *Minimum* indicates the minimum value in the column.
- *Maximum* indicates the maximum value in the column.
- *Range* indicates the range of the numeric values in the column (*Maximum – Minimum*).
- Mean is the arithmetic average of the data values. It is the sum of the data values divided by the number of data values.
- *Median* is the middle value among the data values. Half of the data values are larger than the median and half are smaller than the median. When there are an even number of data values the median is the average of the two middle values.
- Mode is the value that appears most often in a data set. If the data set contains multiple modes, the modes will be displayed separated by a comma. #N/A will be displayed if no mode exists for the data set, i.e. there is an equal number of each data value.
- *First quartile (25thpercentile)* is the value such that one-fourth of the data values are smaller than the quartile and three-fourths of the data values are larger than the first quartile.
- *Third quartile (75thpercentile)* is the value such that three-fourths of the data values are smaller than the quartile and one-fourth of the data values are larger than the third quartile.
- Standard error of the mean
- 95% confidence interval for the mean
- 99% confidence interval for the mean
- Variance
- Average deviation
- Standard deviation
- Coefficient of variation
- Coefficient of skewness
- Coefficient of kurtosis
- Kolmogorov-Smirnov goodness of fit for normal distribution
- Critical Value of K-S statistic at 90% significance level
- Critical Value of K-S statistic at 95% significance level
- Critical Value of K-S statistic at 99% significance level

Data Group

The *Data* group is used to select *Sample* or *Population* statistics. The *Labels in first row* option is also specified in the *Data* group.

Sample or Population

Select *Sample* or *Population* statistics, depending on whether the data represent a statistical sample or the complete set of all possible members of a population.

Labels in the First Row

Check the *Labels in first row* box if the first row of the selection contains descriptive labels. If this box is checked the label appears at the top of the statistics report for each column.

Results Group

The *Results* group is used to show the statistics report in a window or copy the results to a new location of the worksheet.

Show in Window

Select *Show in a window* to write the statistics results to a Statistics Results dialog. The results in this dialog can be copied to the clipboard to paste to other locations.

Copy to Worksheet

Select *Copy to worksheet* to write the statics report to a new location in the worksheet.

Starting in Cell

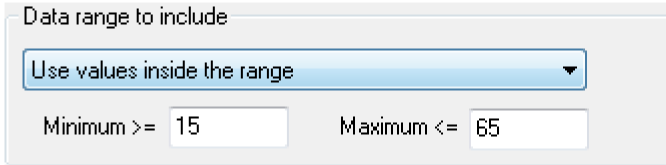
Use the *Starting in cell* box to specify the cell for the upper left corner of the statistics report. If the destination cells contain data, a warning is displayed that data will be overwritten.

Data Range to Include Group

The *Data range to include* contains options to limit the values where the statistics are calculated. Available options are *Use all values*, *Use values inside the range*, *Use values outside the range*, and *Use all values except*.

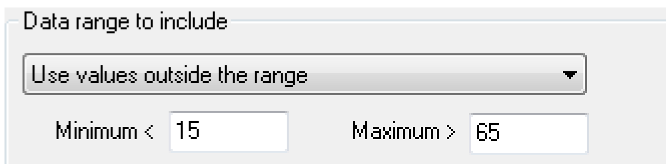
When the *Data range to include* is set to *Use all values*, all of the values in the highlighted section are used to calculate the statistics.

When the *Data range to include* is set to *Use values inside the range,* the *Minimum* >= and *Maximum* <= options are available. Type in the data values that bracket the range of values where the statistics should be calculated. For instance, if the *Minimum* >= is set to 15 and the *Maximum* <= is set to 65, only data points between (and including) 15 and 65 are used for calculating the statistics.



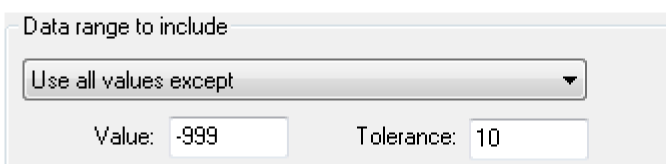
Only the values that are inside the range are included in the calculated statistics.

When the *Data range to include* is set to *Use values outside the range,* the *Minimum* < and *Maximum* > options are available. Type in the data values that bracket the range of values where the statistics should be calculated. For instance, if the *Minimum* < is set to 15 and the *Maximum* > is set to 65, only data points below 15 or greater than 65 (and excluding 15 and 65) are used for calculating the statistics.



Only the values that are outside the range are included in the calculated statistics.

When the *Data range to include* is set to *Use all values except,* the *Value* and *Tolerance* options are available. Type in the data value that should be excluded in the *Value* box. The *Tolerance* value gives a range on either side of the *Value.* Everything in the range *Value-Tolerance* to *Value+Tolerance* is excluded from the statistics calculation. For instance, if the *Value* is set to -999 and the *Tolerance* is set to 10, all values between -1009 and -989 are excluded from the statistics. This means that all values less than -1009 and greater than -989 are included in the statistics calculations.



Only the values that are outside the range Value-Tolerance to Value+Tolerance are included in the calculated statistics.

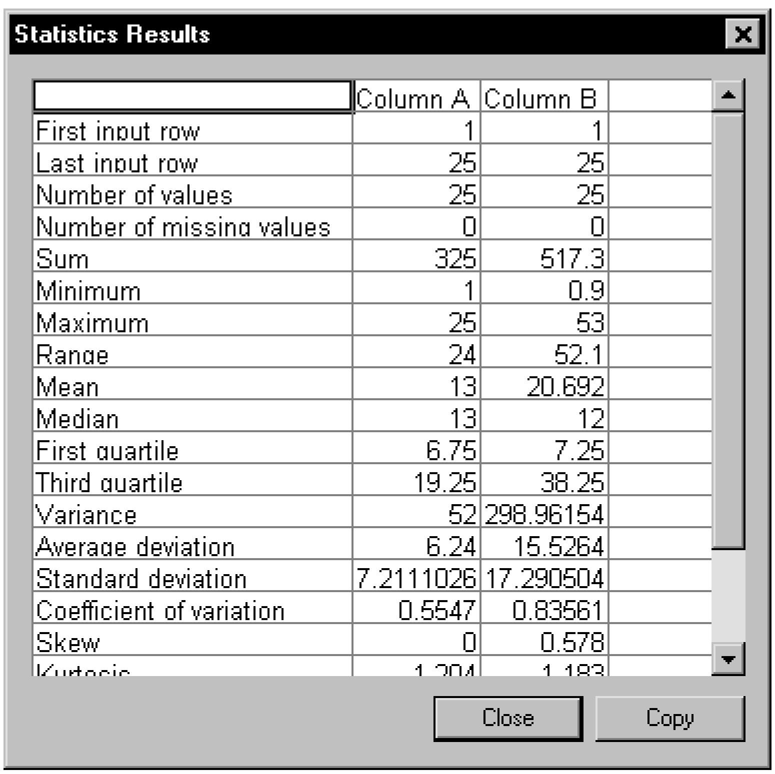
The *Use all values except* option can be used to ignore NoData values. For example, the NoData value for the *HELENS2.grd* sample grid file is 1.70141E+38. Two methods exist for ignoring the blanking value. One method is to enter the *NoData Value* displayed in the [Grid | Info] report exactly into the *Value* field of the **Statistics** dialog. Using *HELENS2.grd* as an example, 1.70141E+38 would be entered into the *Value* field. Another method is to enter an approximation of the NoData value and a tolerance that will include the actual NoData value while excluding the desired data. Using this method with the previous example, 1.70E+38 is entered into the *Value* field and 1E+37 is entered into the *Tolerance* field. Both of these methods result in the **Statistics** command returning results for the data values only.

Statistics Results

When worksheet statistics are computed via the **Data Tools | Data | Statistics** command, the results can be display in the **Statistics Res-ults** dialog. Once the statistics are displayed in a window, they can be copied to the clipboard and pasted in a new location.

Statistics Results Dialog

Select the *Show in a window* option in the *Results* section of the Statistics dialog and click the *OK* button to display the **Statistics Results** dialog.



	Column A	Column B
First input row	1	1
Last input row	25	25
Number of values	25	25
Number of missing values	0	0
Sum	325	517.3
Minimum	1	0.9
Maximum	25	53
Range	24	52.1
Mean	13	20.692
Median	13	12
First quartile	6.75	7.25
Third quartile	19.25	38.25
Variance	52	298.96154
Average deviation	6.24	15.5264
Standard deviation	7.2111026	17.290504
Coefficient of variation	0.5547	0.83561
Skew	0	0.578
Kurtosis	1.204	1.183

*The**Statistics Results**dialog displays the statistics specified in the**Statistics**dialog.*

Copy
Click the *Copy* button to copy the statistic results to the clipboard.

Close
Click the *Close* button to close the **Statistics Results** dialog.

95% and 99%Confidence Interval for the Mean

If CI is the value of the confidence interval reported by the worksheet, the range of values between the sample mean minus CI and the sample mean plus CI is expected to include the true mean of the underlying population 95 percent of the time (for the 95% confidence interval) or 99 percent of the time (for the 99% confidence interval). This formula assumes that the data set is sufficiently large for the central limit theorem to apply.

95% Confidence Interval for the Mean

$$\pm t_{(n-1),\alpha=.05}(SE)$$

99% Confidence Interval for the Mean

$$\pm t_{(n-1),\alpha=.01}(SE)$$

where

$t_{v,\alpha}$	= the value of the Student's t distribution with v degrees of freedom such that difference between the cumulative probability function evaluated at $t_{v,\alpha}$ and $-t_{v,\alpha}$ is equal to $1-\alpha$.
SE	= Standard Error of the Mean

Average Deviation

The average deviation is the average of the difference between the absolute values of data points and the mean.

Population Mean Deviation (MD)

$$MD = \frac{1}{N}\sum_{i=1}^{N}\left|(x_i - \mu)\right|$$

Sample Mean Deviation (MD)

$$MD = \frac{1}{n}\sum_{i=1}^{n}\left|(x_i - \bar{x})\right|$$

where

μ = Population Mean

$\bar{x}$ = Sample Mean

N = number of data values (for a population)

n = number of data values (for a sample)

x_i = i^{th} data value

Coefficient of Kurtosis

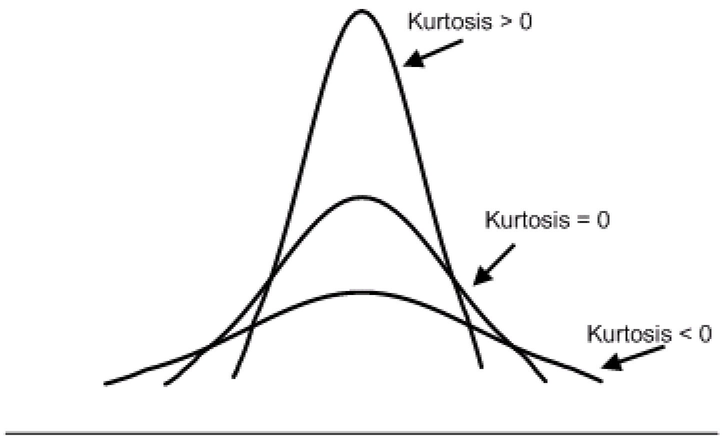
Kurtosis is a measure of the sharpness of the data peak. Traditionally the value of this coefficient is compared to a value of 0.0, which is the coefficient of kurtosis for a normal distribution, i.e., the bell-shaped curve. A value greater than 0 indicates a peaked distribution and a value less than 0 indicates a flat distribution. Without a very large sample size, the use of this coefficient is of questionable value.

Population Kurtosis (γ_2)

$$\gamma_2 = \left(\frac{1}{N\,\sigma^4}\sum_{i=1}^{N}(x_i - \mu)^4\right) - 3$$

Sample Kurtosis (g_2)

$$g_2 = \left\{\frac{n\,(n+1)}{(n-1)(n-2)(n-3)}\sum\left(\frac{x_i - \bar{x}}{s}\right)^4\right\} - \frac{3\,(n-1)^2}{(n-2)(n-3)}$$



(adapted from King and Julstrom, 1982)

where

σ = Population Standard Deviation
S = Sample Standard Deviation
μ = Population Mean
$\bar{x}$ = Sample Mean
N = number of data values for a population
n = number of data values for a sample
x_i = i^{th} data value

Coefficient of Skewness

The coefficient of skewness is a measure of asymmetry in the distribution. A positive skew indicates a longer tail to the right, while a negative skew indicates a longer tail to the left. A perfectly symmetric distribution, like the normal distribution, has a skew equal to zero. For small data sets this measure is unreliable.

Population Skew (γ_1)

$$\gamma_1 = \frac{1}{N\,\sigma^3}\sum_{i=1}^{N}(x_i - \mu)^3$$

Sample Skew (g_1)

$$g_1 = \frac{n}{(n-1)(n-2)} \sum \left(\frac{x_i - \bar{x}}{s} \right)^3$$

(adapted from King and Julstrom, 1982)

where

σ	= Population Standard Deviation
S	= Sample Standard Deviation
μ	= Population Mean
$\bar{x}$	= Sample Mean
N	= number of data values for a population
n	= number of data values for a sample
x_i	= i^{th} data value

Coefficient of Variation

The coefficient of variation is the standard deviation divided by the mean. The worksheet reports the quotient; it does not convert the value to a percentage. The coefficient of variation is a dimensionless measure of variation. This statistic is not defined for the case of a zero mean. In fact, this measure is only useful when dealing with strictly positive data.

Population Coefficient of Variation (V)

$$V = \sigma / \mu$$

Sample Coefficient of Variation (V)

$$V = s / \bar{x}$$

where

σ = Population Standard Deviation
S = Sample Standard Deviation
μ = Population Mean
$\bar{x}$ = Sample Mean

Critical Value of K-S Statistic at 90%, 95%, and 99% Significance Level

The critical value of K-S statistic at 90, 95, or 99 percent significance level are indicators of normal distributions.

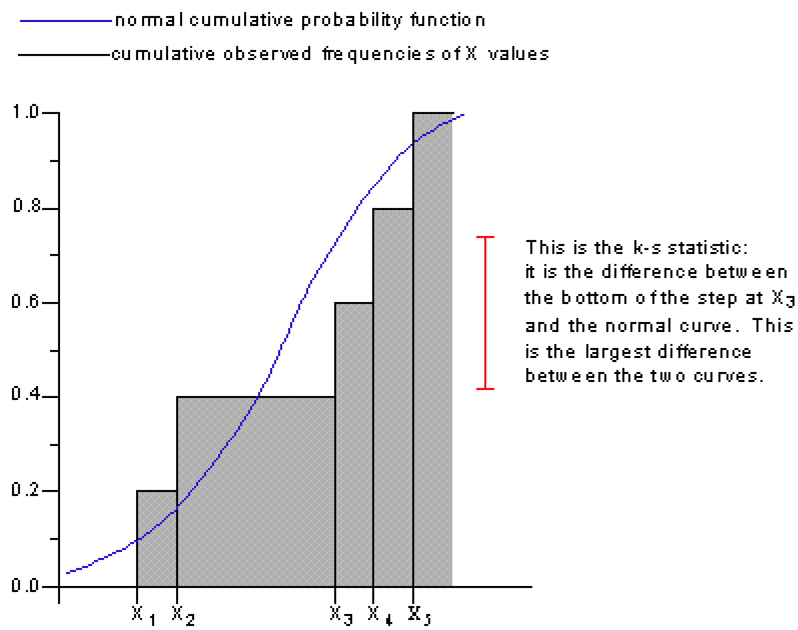
For example, if a sample collected from a population has a normal frequency distribution, the K-S statistic for that sample is less than the critical value 90, 95, or 99 percent of the time. If the K-S statistic is larger than the critical value, the hypothesis that the underlying population is distributed normally with a mean of $\bar{x}$ and a standard deviation of s should be rejected.

Kolmogorov-Smirnov Goodness of Fit Statistic for Normal Distribution

The Kolmogorov-Smirnov statistic is the largest difference between an expected cumulative probability distribution and an observed frequency distribution. The expected distribution used here is the normal probability distribution with mean and variance equal to the mean and variance of the sample data. The observed frequency distribution is a stepped function that increases by 1/n with each step, where n is the number of values in the data set.

For example, suppose that there are five values in a data set. The observed frequency distribution is 0 to the left of the first data point. At the first data point the observed distribution function jumps to 0.2. Since there are five data values, the size of the step at each value is one divided by five. At each successive data value the observed frequency distribution jumps by 0.2.

The K-S statistic is calculated as the largest difference, in absolute value, between the normal cumulative probability function and the observed frequency distribution, as shown below. Note that at each step it is necessary to compute the difference between bottom of the step and the normal curve and between the top of the step and the normal curve.



Mean

The mean is the arithmetic average of the data values. It is the sum of the data values divided by the number of data values.

Population Mean (μ)

$$\mu = \frac{1}{N}\sum_{i=1}^{N} x_i$$

Sample Mean ($\bar{x}$)

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

where

N = number of data values (for a population)

n = number of data values (for

a sample)

x_i = i^{th} data value

Standard Deviation

The standard deviation is the square root of the variance.

Population Standard Deviation (σ)

$$\sigma = \sqrt{\sigma^2}$$

Sample Standard Deviation (*S*)

$$s = \sqrt{s^2}$$

where

σ^2 = Population Variance

S^2 =Sample Variance

Standard Error of the Mean

The standard error of the mean is an estimate of the standard deviation of means that would be found if many samples of *n* items were repeatedly collected from the same population.

Suppose many samples of size *n* were repeatedly collected from the same population and the means of these many samples were calculated. The means of the samples would themselves form a data set. The standard error of the mean is an estimate of the standard deviation of this theoretical sample of means.

Standard Error of the Mean (SE)

$$SE = s / \sqrt{n}$$

Where

S = Sample Standard Deviation
n = number of data values (for a sample)

Variance

The population variance is the average of the squared deviations from the mean. The sample variance is the sum of the squared deviations from the mean divided by one less than the number of data values.

Population Variance (σ^2)

$$\sigma^2 = \frac{1}{N}\sum_{i=1}^{N}(x_i - \mu)^2$$

Sample Variance (s^2)

$$s^2 = \frac{1}{(n-1)}\sum_{i=1}^{n}(x_i - \bar{x})^2$$

where

μ = Population Mean
$\bar{x}$ = Sample Mean
N = number of data values (for a population)
n = number of data values (for a sample)
x_i = i^{th} data value

Statistics References

Gilbert, Richard O. (1987) *Statistical Methods for Environmental Pollution Monitoring*. New York: Van Nostrand Reinhold.

Hildebrand, David K. (1986) *Statistical Thinking for Behavioral Scientists.* Duxbury Press.

Hines, William W. and Douglas C. Montgomery. (1980) *Probability and Statistics in Engineering and Management Science*, 2nd edition, New York: John Wiley and Sons.

King, Ronald S. and Bryant Julstrom. (1982) *Applied Statistics Using the Computer*. Sherman Oaks, California: Alfred Publishing Company.

Press, William H. et al. (1992) *Numerical Recipes in C: The Art of Scientific Computing*. New York: Cambridge University Press.

Sheskin, D.J. (2000) *Handbook of Parametric and Nonparametric Statistical Procedures, Second Edition.* Boca Raton, Florida: Chapman & Hall/CRC.

Sokal, Robert R. and F. James Rohlf. (1981) *Biometry: Principles and Practices of Statistics in Biological Research*. New York: Freeman and Co.

Spiegel, Murry R. (1961) *Schaum's Outline of Theory and Problems of Statistics*. New York: McGraw-Hill Inc.

Zar, Jerrold H. (1974) *Biostatistical Analysis*. Englewood Cliffs, New Jersey: Prentice Hall.

Transpose

The **Data Tools | Data | Transpose** command rearranges data from columns to rows or from rows to columns. To quickly switch the layout of your data, highlight the data that should be flipped. Click the **Data Tools | Data | Transpose** command and the columns become rows and the rows become columns.

For example, consider the following data:

	A	B	C	D	E
1	Category	Spring	Summer	Fall	Winter
2	A	12	14	15	21
3	B	13	5	23	12
4	C	51	21	12	32

Categories A, B, and C are displayed with each category in a row.

Highlight the rows 1-4. Click the **Data Tools | Data | Transpose** command and the data appears in columns:

	A	B	C	D
1	Category	A	B	C
2	Spring	12	13	51
3	Summer	14	5	21
4	Fall	15	23	12
5	Winter	21	12	32

Categories A, B, and C are now displayed with each category in a separate column. This makes it easier to compare the data in a graph, such as a box-whisker plot.

Text To Number

Click the **Data Tools |Data | Text to Number** command to convert text strings in selected cells to numbers. This command will eliminate extraneous zeros and convert text to simplified numeric format.

To determine if the cell contains a number formatted as text, click on the cell to select it. The cell edit box displays the number formatted as text with an ' before the number. For instance, in the image below, the number 3 appears as '003 since the number is formatted as text.

To convert text to numbers:

1. Select the cell or cells to convert.
2. Click the **Data Tools | Data | Text to Number** command.

A4 | '003

	A	B
1	X	Y
2	1	1
3	2	1
4	003	7
5	4	2
6	5	5

In this example the number 3 is stored as text in the form '003. Notice the cell edit box *contains an apostrophe before the number.*

A4 | 3

	A	B
1	X	Y
2	1	1
3	2	1
4	3	7
5	4	2
6	5	5

The text is converted to a number. The cell is right aligned and the cell edit box does not contain an apostrophe before the number.

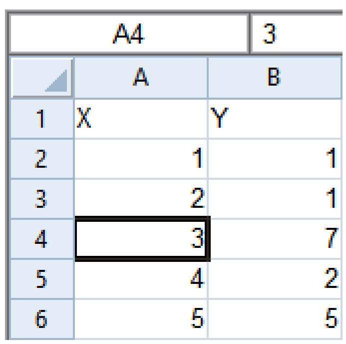
Number To Text

Click the **Data Tools | Data | Number to Text** command to convert numeric data in selected cells to text string format.

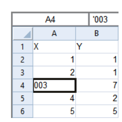
To determine if the cell contains a number formatted as text, click on the cell to select it. The cell edit box displays the number with an ' before the number if the number is stored as text. In the example below, the number 3 is converted to '003 as the number is formatted as text.

To convert a numeric value to text:

1. Select the cell or cells to convert to text.
2. Click the **Data Tools | Data | Number to Text** command. The **Number to Text** dialog opens.
3. Select the desired text options in the **Number to Text** dialog.
4. Click *OK* and the numeric values are converted to text.



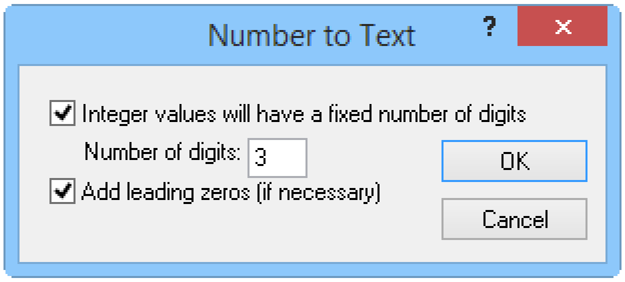
Notice in this example the Active Cell Edit Box *does not contain an apostrophe before the number.*



The number 3 *has been converted to text. The cell contents are left aligned and the cell edit box contains an apostrophe before the number.*

Number to Text Dialog

The **Number to Text** dialog is displayed when the **Data Tools | Data | Number to Text** command is clicked.



Specify the number of digits and whether the text string is padded with leading zeros or spaces.

Fixed Number of Digits

Checking the *Integer values will have a fixed number of digits* box will fix the number of digits the cell contains to the value set in the *Number of digits* input box. **Grapher** will not round or truncate any numeric data if the number length is greater than the length specified in the *Number of digits* input box. The number will be converted to text but otherwise be unchanged.

Leading Characters

When the *Integer values will have a fixed number of digits* box is checked, the *Add leading zeros (if necessary)* option is enabled. Checking the *Add leading zeros (if necessary)* box will add leading zeros to numeric data with fewer digits than the number specified by the *Number of digits* value. If the *Add leading zeros (if necessary)* box is not checked, spaces will be added to data with the fewer digits than the number specified above. If *Integer values will have a fixed number of digits* is not checked, the *Add leading zeros (if necessary)* option will be disabled.

Page Setup - Worksheet

The **File |Page Setup** command sets the page formatting and printing information for the worksheet.

Page Setup Dialog

The **Page Setup** dialog has three pages to set printing options; the Page, Margins, and Options pages.

Page

Use the Page options to set paper size, source, orientation, and scaling.

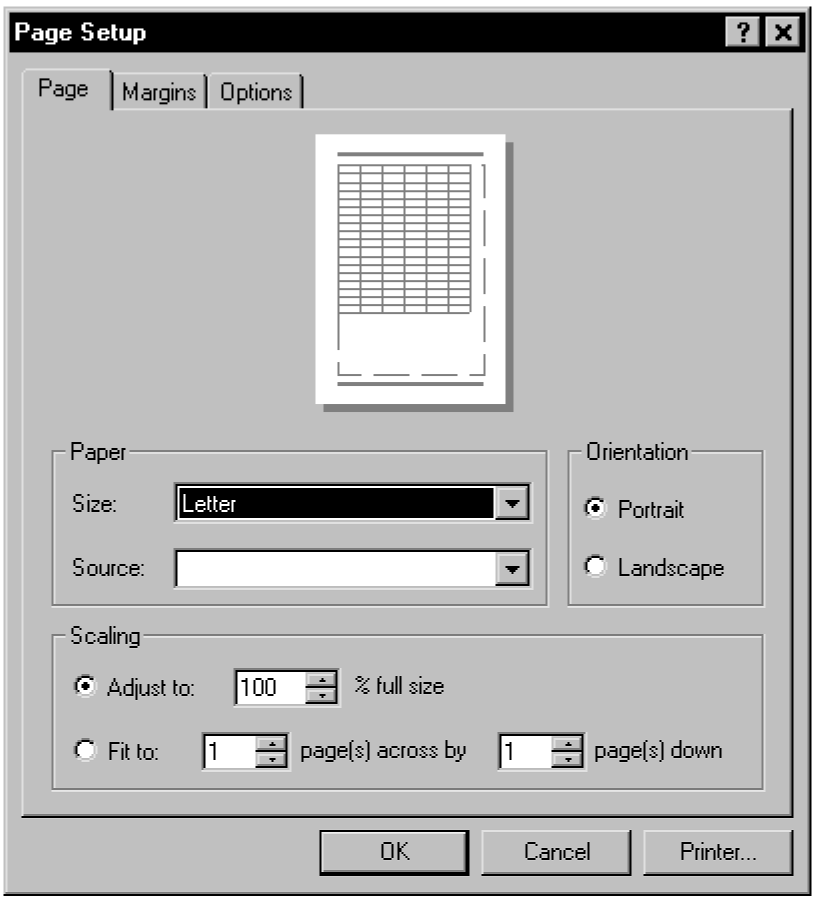
Margins

Use the Margins page to set page margins, header and footer positions, and centering.

Options
Use the Options page to set gridlines, page order, and content of headers and footers on worksheet prints.

Page Setup Worksheet - Page

Use the **Page** options found in the worksheet's File | Page Setup command to set paper size, source, orientation, and scaling.



*Change page setup properties in the**Page Setup**dialog**Page**page.*

Paper

Use the *Paper* group to choose the paper *Size* and *Source* for the active printer.

- The *Size* option allows you to select the size of paper. Click the down arrow next to the paper *Size* to change the size of the paper. The paper size options available for your printer are listed in the drop-down list.
- The *Source* option allows you to select the paper source. If your printer has multiple print trays, choose the paper *Source* by clicking the down arrow.

Orientation

Orientation sets the page in either *Portrait* or *Landscape* mode.

- Select *Portrait* to have a vertical page.
- Select *Landscape* to have a horizontal page.

Scaling

Scaling controls the print size for the worksheet. There are two options with *Scaling*:

- The *Adjust to ___ % full size* option sets the percent of full size that worksheet prints. The arrow buttons are used to scroll up or down from 100 percent (full size), or values can be entered into the box.
- The *Fit to __ page(s) across by __ page(s) down* option tells the program to print the worksheet at 100 percent scale or less. This option does not automatically scale the printed worksheet at greater than 100 percent. This is most useful when the worksheet is large and the number of printed pages needs to be limited.

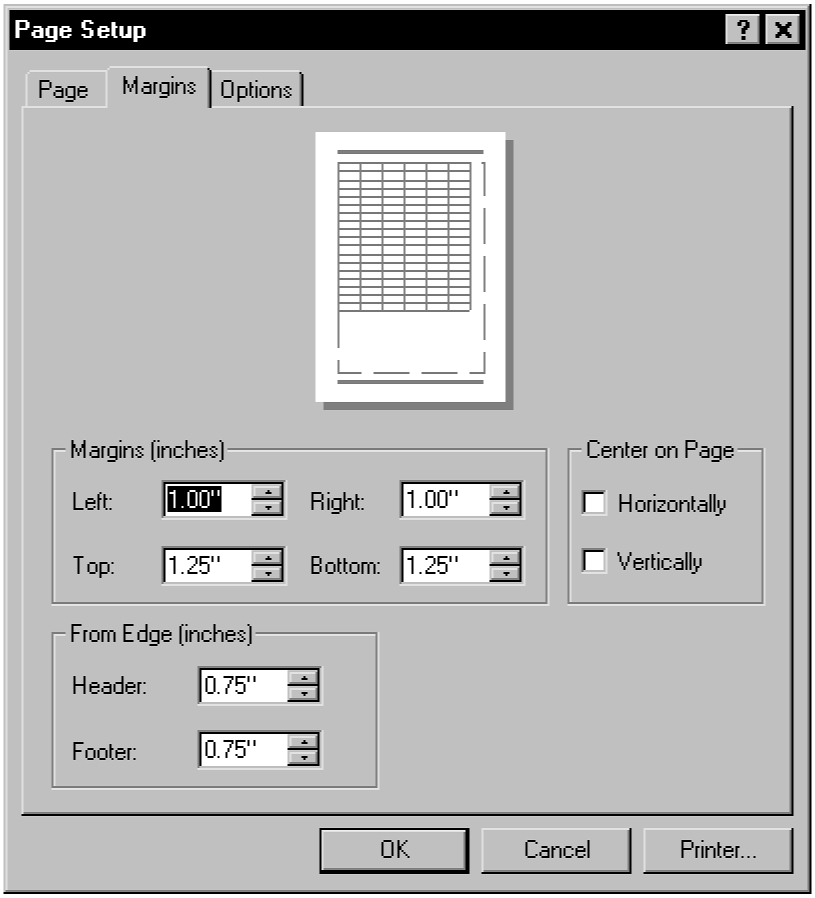
The amount of data in the worksheet determines how many pages are required to print the worksheet. This is independent of the *Fit to* option.

Printer

The active printer can be changed by clicking the *Printer* button.

Page Setup Worksheet - Margins

Use the **Margins** page found using the worksheet's File | Page Setup command to set page margins, header and footer positions, and centering.



Change page margin properties in the ***Page Setup*** *dialog* ***Margins*** *page.*

Margins
Use the *Margins (inches)* options to set the page margins for all sides of the printed page. Set the *Left*, *Right*, *Top*, and *Bottom* values in inches to any values the printer allows. The margins are for the worksheet printout and are independent of the settings used for *Headers* or *Footers*. If the *Top* or *Bottom* margins are set to a value lower than the header or footer it is possible that the text can be overwritten.

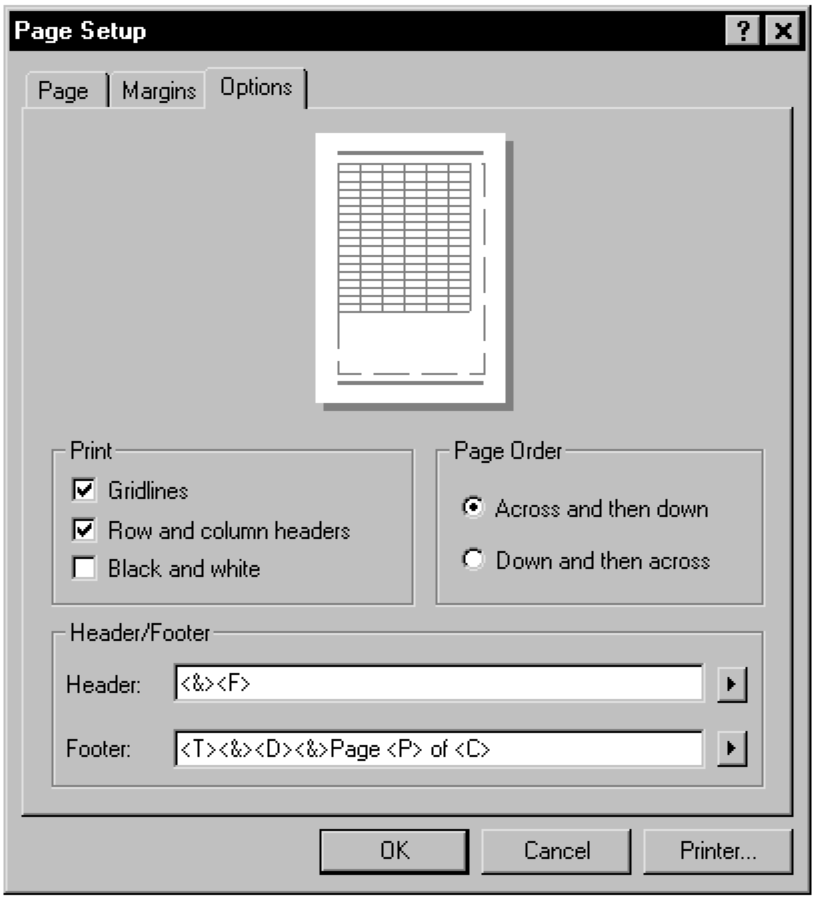
Center on Page
The *Center on Page* options automatically center the printout *Horizontally*, *Vertically*, or both. If this option is not used the worksheet prints in the upper left corner of the page.

From Edge (inches)
The *From Edge (inches)* options controls how far the *Header* or *Footer* is printed from the edge of the page. If these values are greater than the *Top* or *BottomMargins* it is possible that the worksheet data can print over

the header or footer. The text that is printed for the header and footer is controlled from the Options page.

Page Setup Worksheet - Options

Use the **Options** page found in the worksheet's File | Page Setup command to set gridlines, page order, and content of headers and footers on worksheet print outs.



Change page option properties in the ***Page Setup*** *dialog* ***Options*** *page.*

Print

The *Print* group controls how the worksheet information is printed.

- Check the *Gridlines* option to draw gridlines separating each column and row.
- Check the *Row and column headers* option to print the column letters and row numbers of the worksheet.
- If cells contain color backgrounds, set with the Data Tools | Format |

[Format Cells] command, use the *Black and white* option to print the worksheet in black-and-white on color printers.

Page Order

The *Page Order* group controls the order in which multiple pages are printed.

- The *Across and then down* option prints from left to right first and then moves down and prints left to right again.
- The *Down and then across* option prints the worksheet from top to bottom first and then moves to the right and prints top to bottom again.

Headers and Footers

The *Header/Footer* group controls the type of information included in the worksheet data print out. The *Header* appears at the top of the page, and the *Footer* appears at the bottom of the page. The header and footer are spaced from the edge of the page based on the *From Edge* option of the [Margins] page. Descriptive text can be typed in the *Header* and *Footer* boxes. Automatic text can be added to the *Header*or*Footer*boxes by clicking the arrows to the right of the boxes and clicking the items in the list.

Automatic header/footer codes:

- *File Name* (< F>) prints the name of the active file. The drive and path are not included.
- *Page Number* (<P>) prints the page number for each page. When several pages are printed the order of printing is controlled from the *Page Order* option.
- *Total Page Count* (< C>) prints the total number of pages that are required to print out the worksheet.
- *Current Date* (<D>) prints the current date.
- *Current Time* (< T>) prints the current time.
- *Left/Center/Right Separator* (<&>) separates the header and footer text so it is spread out across the page. Too many separators can actually push text off the page. If this happens, remove the <&> separator and use spaces instead.

Examples

For a six-page document, <&><&>Page <P> of < C> would print (on the right side of the first page):

```
                                        Page 1 of 6
```

Enter Joe Smith<&>< F><&><D> to print out a name, file name, and date:

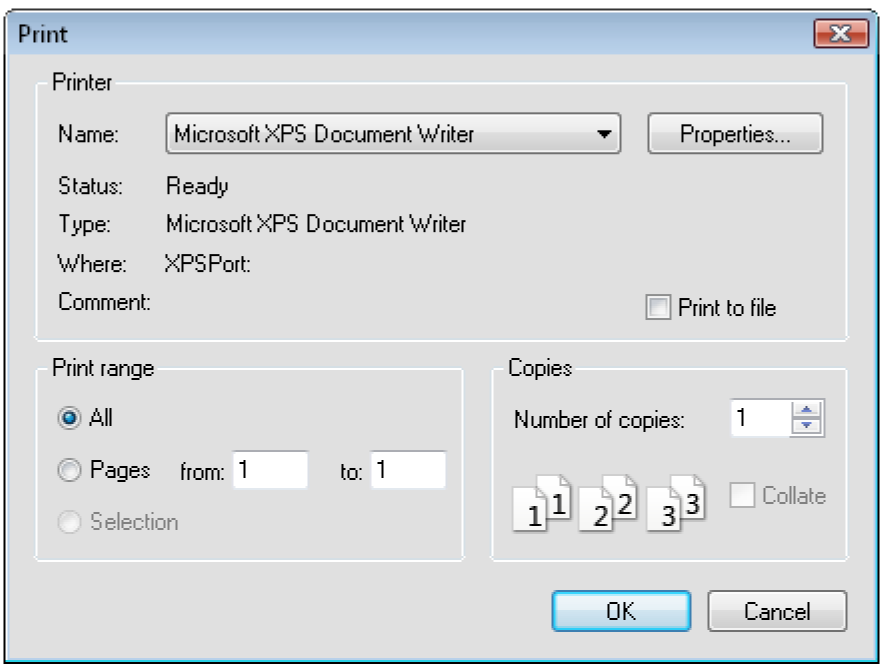
```
Joe Smith          COLORADO.DAT
             01/05/10
```

To print centered text use the "&" operator one time, such as <&>< F>:

```
FILENAME.DAT
```

Print - Worksheet

Click the **File |Print** command in the worksheet, or the  button in the Quick Access Toolbar to open the **Print** dialog and print the contents of the worksheet to the active printer or to a .PRN file. To control the display of data on the printed page, refer to the File | Page Setup command. While the worksheet is spooling, a dialog appears indicating that printing is progressing.



*Set the printer properties in the **Print**dialog.*

Printer

The *Printer* group contains information about the printer and options to specify the printer.

- The default printer is listed in the *Name* field.
- Use the *Properties* button to specify a printer and the printer properties. For information on specific printer settings, see the owner's manual for the printer.
- The *Print to file* check box allows you to print the data to a .PRN file. .PRN files are ASCII text files. When this option is highlighted, and the *OK* button is pressed in the **Print** dialog, enter a path and file name in the **Print to File** dialog.

Print Range

The *Print range* options control how the worksheet pages are printed.

- *All* prints all the pages that contain data.
- *Pages* prints the pages specified.
- *Selection* prints the selected worksheet cells.

Number of Copies

The *Number of copies* option specifies the number of copies to print.

Collate

When printing multiple-page documents two or more times, check the *Collate* box to assemble the printed pages in proper order.

OK or Cancel

Click *OK*to print the worksheet. Click *Cancel* to abort the **Print** command and return to the worksheet window.

Creating Graphs

You can create graphs in several ways in **Grapher**. These methods include creating graphs with the graph wizard, from the Home tab commands, from the worksheet, and from templates.

Additional plots, axes, legends, titles, summation plots, duplicate axes, and magnifiers can be added to the graph after it is created. All properties of the plot can be edited after the graph is created.

Creating Graphs with the Graph Wizard

The Graph Wizard leads you through the necessary steps to create a new graph. This is often the fastest way to make a graph with multiple plots from a single data file. The **Graph Wizard** also makes it easy to add items such as axes, legends, and titles.

To create a graph with the graph wizard:

1. Click the **Home | New Graph | Wizard** command.
2. In the **Graph Wizard - Select Data** dialog, select the data file for the graph from the *Select File* list. A preview of the data file is displayed in the *Data Preview* section.
3. Click the *Next* button.
4. In the **Graph Wizard - Select Plot Type** dialog, choose a plot type for the new graph. Filter available *Plot types* with the *Category* list or search for plot types with the *Search* bar. See a description of the selected plot type in the *Description* section, or click *Help* to view descriptions for all plot types.
5. After selecting a plot type, define the number of plots you wish to create and their associated data columns in the *Data Columns* section.
6. Click the *Next* button.
7. In the **Graph Wizard - Properties** dialog, select which graph components you wish to display. If the graph contains multiple plots, you can select a *Color palette* for the plots as well.
8. Click the *Finish* button to create the graph.

The graph is created with the specified properties. You can change the properties of a selected graph, plot, or axis through the Property Manager.

Creating Graphs in the Plot Window

The most common method of creating graphs is to use the **Home | New Graph** commands. To create a graph in the plot window:

1. Click or scroll to the **Home** tab.
2. In the **New Graph** group, click the **Basic**, **Bar**, **Polar**, **Ternary**, **Specialty**, **Statistical**, or **Contour Surface** plot category.
3. Click on the plot type you would like to create.
4. Select a data file in the **Open Worksheet** dialog and click *Open*. If you are creating a contour grid map or surface grid map, you are prompted for a .GRD file. If you are creating any type of function plot, you are not prompted for a data or grid file.

The graph is created with the default properties. You can change the properties of a selected plot or axis through the Property Manager.

Creating Graphs from the Worksheet

If you are working with the data in the worksheet, you can create a graph without switching to the plot window. Simply select the columns you wish to plot and choose the graph type you wish to create. To create a graph from the worksheet:

1. Open the worksheet you wish to use for the plot or plots.
2. Highlight the columns to use in the plot or plots.
3. Click the **Home** tab. If you are using the **Worksheet Manager**, right-click in the worksheet and select **Home | New Graph** from the context menu.
4. In the **New Graph** group, click the **Basic**, **Bar**, **Polar**, **Ternary**, **Specialty**, **Statistical**, or **Contour Surface** button. In the **Worksheet Manager**, click the **Basic**, **Bar**, **Polar**, **Ternary**, **Specialty**, **Statistical**, or **Contour Surface** in the context menu.
5. Select the plot type you would like to create and the graph is created with the default plot properties.

When creating a graph with multiple plots, the plot colors are automatically varied. You can change the properties of a selected plot or axis through the Property Manager.

Creating Graphs Using Templates

Templates are used to set graphing preferences in **Grapher**. A template file does not contain any reference to a data file. This means that once the template graph is created, you can use the template to create a new graph with any compatible data set. To create a new plot from a template:

1. Click the **File | New | Plot from Template** command.
2. Select a .GRT template file in the **Open** dialog, and click *Open*.
3. Select the data file to use with the template. Select the *Use this worksheet for remaining items* option if all the plots in a template use the same worksheet.
4. Check the *Set columns* if you want to change the column specifications for individual plots in the graph.
5. Click the *Open* button and the new plot is created.

You can change the properties of a selected plot or axis through the Property Manager. Refer to template graphs for information on creating or saving an edited template.

Graph Wizard

Click the **Home | New Graph | Wizard** command to open the **Graph Wizard**. The **Graph Wizard** leads you through the necessary steps to create a new graph. This is the simplest and fastest way to make a graph with multiple plots. The **Graph Wizard** also makes it easy to add items such as axes, legends, and titles. For the most part, default plot parameters are used to create the plots. Alternatively, graphs can be created with the other commands on the Home tab.

The **Graph Wizard** consists of three dialogs:

1. Graph Wizard - Select Data where you select the data file you wish to plot.
2. Graph Wizard - Select Plot Type where the plot type, number of plots, and data columns are defined for the graph.
3. Graph Wizard - Properties where legends, axes, titles, gridlines, and colors are specified for the graph.

The **Graph Wizard** will create the new graph in the current plot document when viewing a plot window. The **Graph Wizard** will create the new graph in a new plot document when using the **Graph Wizard** from the worksheet. Note, **Graph Wizard** operations are not recorded by the Script Recorder. If you wish to record a script of the graph creation process, use the **Home | New Graph** commands.

Using the Graph Wizard to Create a New Graph

To create a new graph with the graph wizard:

1. Click the **Home | New Graph | Wizard** command.
2. In the **Graph Wizard - Select Data** dialog, select the data file for

the graph from the *Select File* list. A preview of the data file is displayed in the *Data Preview* section.

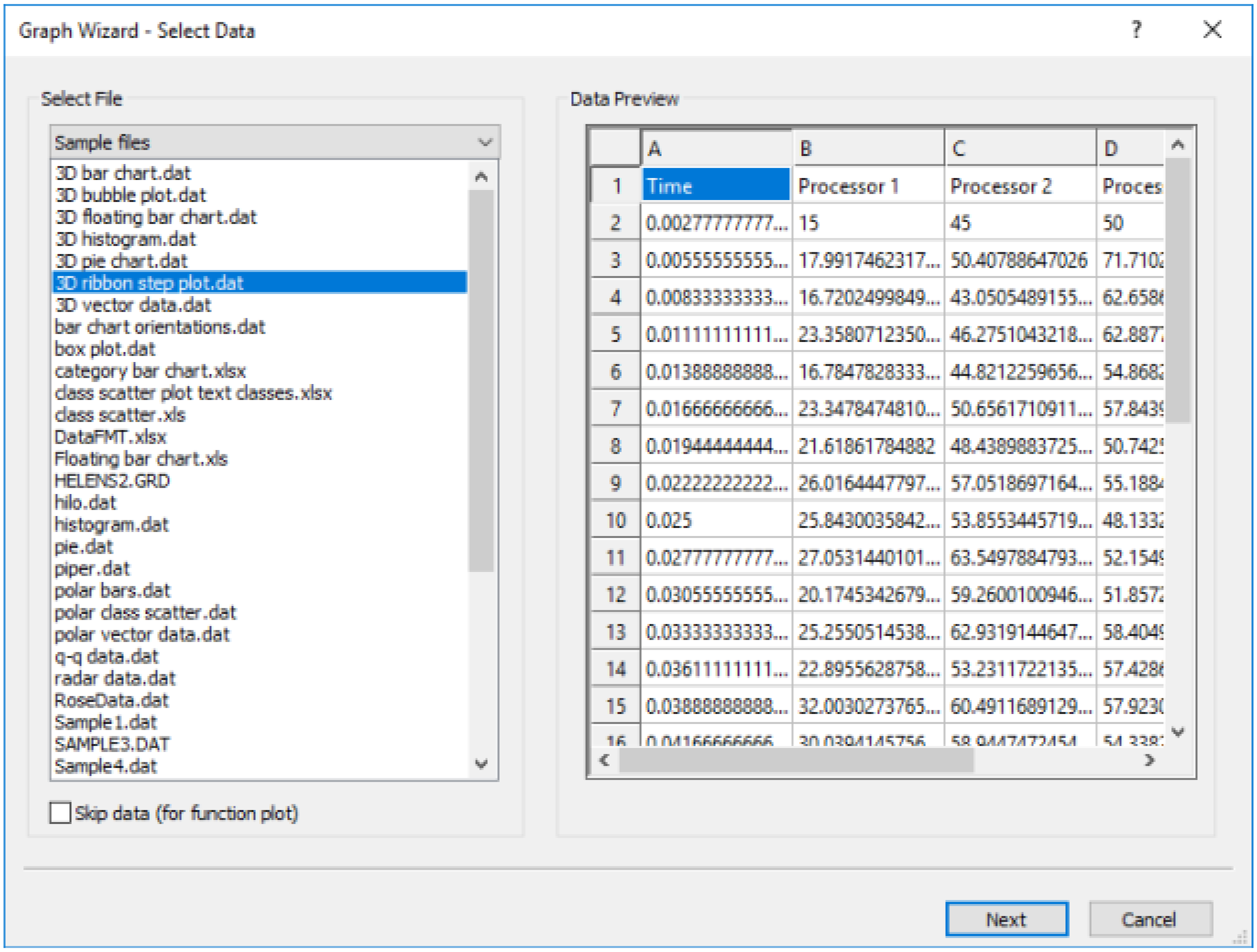
3. Click the *Next* button.
4. In the **Graph Wizard - Select Plot Type** dialog, choose a plot type for the new graph. Filter available *Plot types* with the *Category* list, and search for *Plot types* with the *Search* bar. See a description of the selected plot type in the *Description* section, or click *Help* to view descriptions for all plot types.
5. After selecting a plot type, define the number of plots you wish to create and their associated data columns in the *Data Columns* section.
6. Click the *Next* button.
7. In the **Graph Wizard - Properties** dialog, select which graph components you wish to display. If the graph contains multiple plots, you can select a *Color palette* for the plots as well.
8. Click the *Finish* button to create the graph.

Function Plots

A data file does not need to be selected when creating a function plot since no data are required for this type. If you wish to create a function plot, select the *Skip data (for function plot)* option on the Graph Wizard - Select Data page. Generally it is preferable to create a function plot via the **Home | New Graph** commands.

Graph Wizard - Select Data

The first step when creating a graph with the **Graph Wizard** is to select a data file. The **Graph Wizard - Select Data** dialog is displayed when the **Home | New Graph | Wizard** command is clicked. After specifying a data file, click *Next* to proceed to the Graph Wizard - Select Plot Type dialog.



Select the data file with which to create the graph in the ***Graph Wizard - Select Data*** *dialog.*

Select File

The *Select File* section of the **Graph Wizard -Select Data** dialog includes a list of files where the desired file can be selected. The *Select File* list can display *Recent files*, Project files, Sample files, files in a specific folder (*Browse*), and *Open files*.

Selecting a File

Click on a file in the *Select File* list to select it. If specifying import options is necessary, the appropriate **Import Options** dialog will be displayed. See the *File Format Chart* topic for a list of supported file formats. Once the file has been selected and loaded, a preview of the data file is displayed. Once you have selected the data file you wish to use, click *Next*.

Recent Files

Select *Recent files* in the *Select File* section to display recently opened or used files in the *Select File* list.

Project Files

Select *Project files* in the *Select File* section to display the files in the project folder in the *Select File* list. Specify the project folder in the **Options** dialog General page or by clicking *Set Project Folder* in the Welcome to Grapher dialog.

Sample Files

Select *Sample files* in the *Select File* section to display the files in the **Grapher** samples folder in the *Select File* list. The samples folder is located at C:\Program Files\Golden Software\Grapher 15\Samples by default.

Browse

Select *Browse* in the *Select File* section to browse to a specific file in the Open dialog. Select a file in the **Open** dialog and click *Open* to select the file in the **Graph Wizard**. After you select the file, all of the files in the same folder are also displayed in the *Select File* list.

Open Files

Select *Open files* in the *Select File* section to list currently open worksheet and grid files in the *Select Files* list.

Skip Data

If you wish to create a function plot, select the *Skip data (for function plot)* option. Note that generally it is faster and easier to create a function plot by using one of the **Home | New Graph** commands. Add a function plot to an existing graph by selecting the graph can clicking the **Home | Add to Graph | Plot** command.

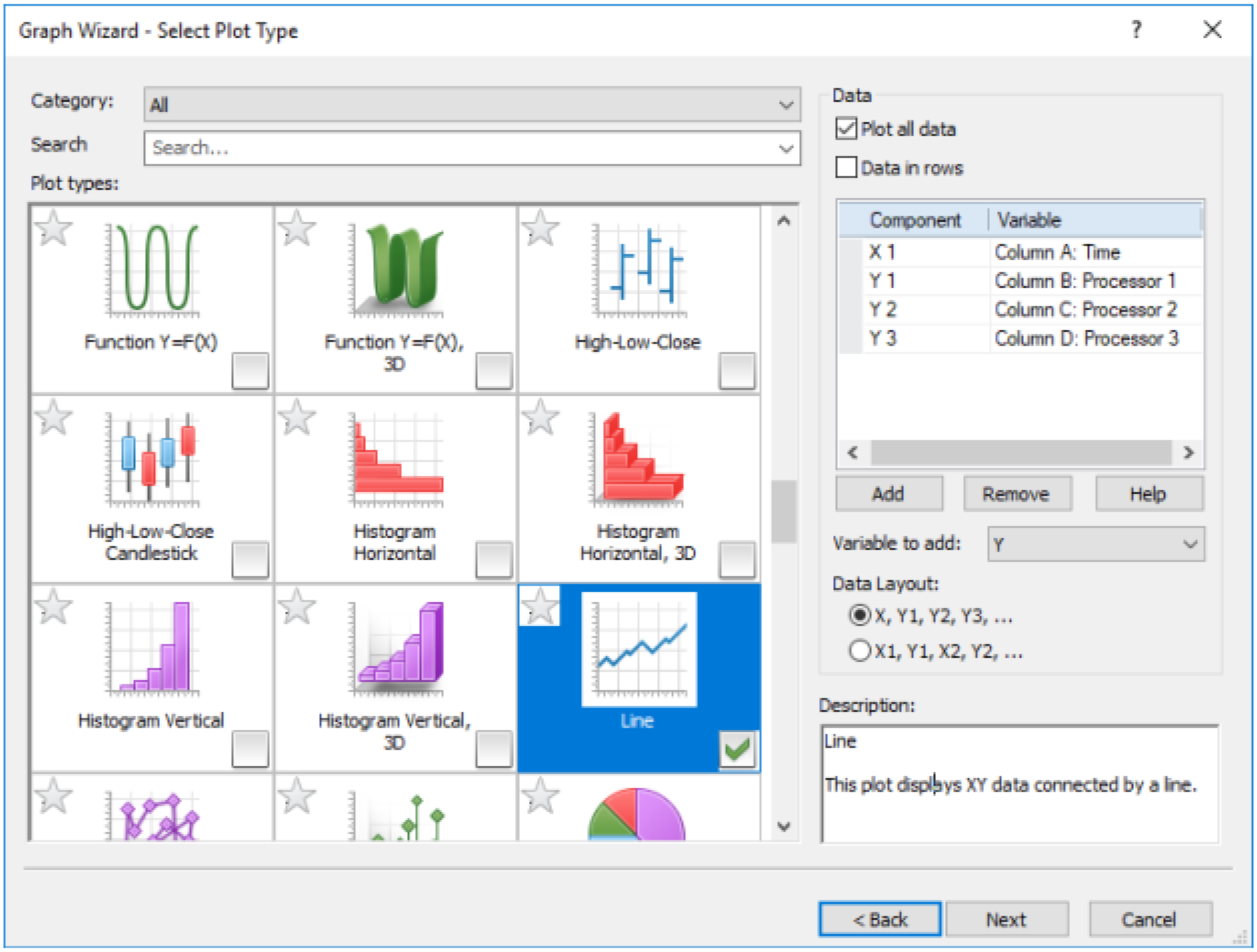
Data Preview

The *Data Preview* displays the selected data file in a read-only table. A data preview is not available for grid files. Use the *Data Preview* to verify the desired file is selected.

Graph Wizard - Select Plot Type

The second step when creating a graph with the **Graph Wizard** is to select a the desired plot type and specify the data columns. The **Graph Wizard - Select Plot Type** dialog is displayed after clicking *Next* in the

[Graph Wizard - Select Data](#) dialog. After selecting a plot type and specifying the data columns, click *Next* to proceed to the [Graph Wizard - Properties](#) dialog. Click *Back* to return to the **Graph Wizard - Select Data** dialog.



*Select the plot type and data columns for the graph in the **Graph Wizard - Select Plot Type** dialog.*

Plot Types

The left side of the dialog displays all available plot types for the data file selected in the **Graph Wizard - Select Data** dialog. Click a plot type to select it. Once a plot type is selected, the *Data Columns* options are available.

The *Plot types* list can be limited to a specific *Category* or filtered by a *Search* term. Plot types can also be added to your *Favorites* category to quickly access your most used plot types.

Click the star to add a plot type to your *Favorite* category. The star is filled when a plot type is in the *Favorites* list. Click the filled star to remove the plot type from the *Favorite* category.

Category

Select a *Category* to limit the plots in the *Plot types* list to one of the pre-defined categories: *All*, *Favorite*, *Bar*, *Bubble*, *Class*, *Contour/Surface*, *Function*, *Histogram*, *Line*, *Pie/Doughnut*, *Polar*, *Scatter*, *Speciality*, *Statistical*, *Ternary*, and *Vector*.

Search

Begin typing in the *Search* field to filter the plot types by name. The *Plot types* list updates as soon as a character is typed. The *Search* is not case sensitive, but the search term must exactly match a portion of the plot type name. However, the search term does not need to match the entire plot type name. For example, searching "vertical" will return the various *Bar Vertical*, *Box Vertical*, and *Histogram Vertical* plot types in the *Plot types* list, but searching "vertical bar" will return no plots in the *Plot types* list.

Data

Once a plot type is selected, the options in the *Data* section are available. The *Data* section includes the options for specifying the number of plots in the graph and which data columns or rows are used to create the plots.

Data in Rows

Select the *Data in rows* option if your data file is formatted with data in rows. The *Variable* list will update with row numbers to specify for the plot *Components*.

Component

The *Component* list describes number of plots and the type of data needed for the plot: X, Y, Z, Size, Class, Category, Label, Data, Radius, Direction, Angle, Magnitude, Speed, dX, dY, dZ, First, Last, Left, Right, Anion, Cation, Date, Open, High, Low, or Close.

The *Component* also indicates the plot number. The plot number follows the *Component* name, for example *X 1* and *Y 1* are the XY pair for plot 1, and *X 2* and *Y 2* are the XY pair for plot two. Many two-variable plots allow one component to be shared automatically, e.g. *X 1*, *Y 1*, *Y 2* leads to two plots: *X 1 Y 1* and *X 1 Y 2*. In the case where every component must be specified, data can be shared between plots by setting the *Column* to the same data file column.

The *Component* for floating bar charts includes two numbers. The first number corresponds to the start and end of the bar, and the second number corresponds to the plot number. For example, Y1 2 is the Y start value for plot 2, and Y2 2 is the Y end value for plot 2.

Variable

The *Variable* is the data column/row you wish to use for the *Component*. Click the current *Variable* to select the desired data column/row from the list. The list includes *Row/Column number*, *Sequence number*, and numeric data columns/rows. For some *Components*, such as Label or Class, text columns/rows will also be displayed in the *Variable* list.

If the data file includes a header row/column, the column/row header will be displayed after the column letter or row number. Use the *Back* button to view the *Data Preview* if you need to view the data file to ensure you select the correct column/row.

Plot All Data

Select the *Plot all data* option to automatically add as many plots as necessary to use every data column/row in the data file. **Grapher** will automatically add new components to the *Component* column. Clear the *Plot all data* check box to reduce the number of components to the minimum required for a single plot.

Which components are added to the *Component* list when *Plot all data* is selected is controlled by the *Data Layout* and *Variable to add* options.

Data Layout

The *Data Layout* options control whether one data column/row is shared across all plots: the *X, Y1, Y2, Y3, ...* option, or whether each *Component* must be specified: the *X1, Y1, X2, Y2, ...* option. The *Data Layout* options are available for most plots that require two data columns/rows.

The *Data Layout* options are not available for any plots that require three or more data columns/rows, and the *Data Layout* options are also disabled for some two-component plots. A single data *Variable* can be shared between plots by setting multiple *Variable* fields to the same data file column/row when the *X1, Y1, X2, Y2, ...* optionis used.

Variable to Add

The *Variable to add* option is available when the *Data Layout* is set to *X, Y1, Y2, Y3, ...* The *Variable to add* is the *Component* variable that is unique to each new plot. For example when *Variable to add* is set to *Y* in a line plot, all plots share a single *X* variable and have independent *Y* values. When *Add* is clicked or *Plot all data* is selected, a new *Component* of the *Variable to add* type is added to the *Component* list.

The *Variable to add* option is not available when the *Data Layout* is set to *X1, Y1, X2, Y2, ...* The *X1, Y1, X2, Y2, ...* data layout adds all the required *Components* for each plot when *Add* is clicked or *Plot all data* is selected.

Adding and Removing Components

Click *Add* to add another plot to the *Component* list. One or more components is added to the *Component* list when *Add* is clicked. When the *Data Layout* is set to the *X, Y1, Y2, Y3, ...* option, the *Variable to add* is added to the *Component* list. When the *Data Layout* is set to the *X1, Y1, X2, Y2, ...* option, all the required components for the selected plot type are added to the *Component* list. After adding a new plot, specify the desired *Column* for the new component(s).

Click *Remove* to remove the components associated with the largest plot number in the list. The plot with the largest plot number is always the component or components at the bottom of the *Component* list.

Help

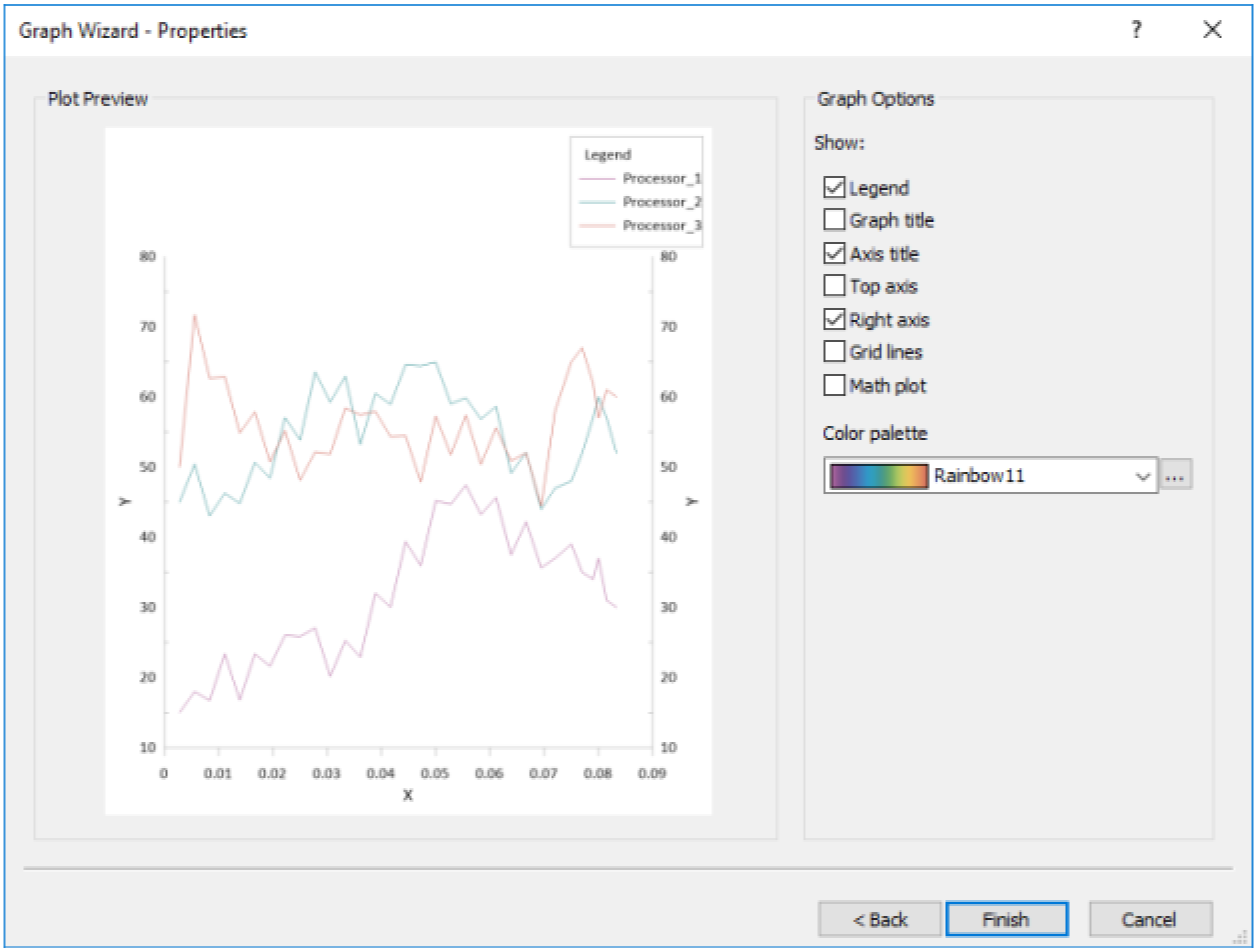
Click *Help* to view the Plot Type Description dialog. This dialog presents all of the plot type descriptions in a single table. This table can be used to determine the data requirements and display style for all **Grapher** plots without needing to select every plot type in the **Graph Wizard**.

Description

The *Description* section displays a short description of the selected plot type. The description includes which type of data is required for the plot and a brief description of the plot appearance.

Graph Wizard - Properties

The final step when creating a graph with the **Graph Wizard** is to select Graph options and plot colors. The **Graph Wizard - Properties** dialog is displayed after clicking *Next* in the Graph Wizard - Select Plot Type dialog. After selecting the graph options, click *Finish* to create the graph. Click *Back* to return to the **Graph Wizard - Select Plot Type** dialog.



Select the properties for the graph in the ***Graph Wizard - Properties*** *dialog.*

Plot Preview

The *Plot Preview* displays a preview of graph that will be created by the **Graph Wizard**. The plots created in the **Graph Wizard - Select Plot Type** dialog and the selected *Graph Options* control the appearance of the graph. Click *Back* to return t the **Graph Wizard - Select Plot Type** dialog and modify the *Component* and *Column* selections if the plots are not as desired.

Graph Options

The *Graph Options* section controls which elements are displayed in the graph and the colors of the plot line, fill, and/or symbols.

Legend

Select the *Legend* option to include a legend in the graph. If your graph includes one of the class scatter plot types, you may wish to use the **Property Manager** Plot page *Display legend* option instead.

Graph Title

Select the *Graph title* option to include a graph title. The graph title is set to the plot type name in the **Graph Wizard**. Once the graph is created, change the graph title on the **Property Manager**Title page.

Axis Title

Select the *Axis title* option to include titles for each of the axes. Once the graph is created, change the axis titles on the **Property Manager**Axis page.

Add Axes

Select the *Top axis* option to add an X axis at the top of the graph. Select the *Right axis* option to add a Y axis to the right of the graph.

Grid Lines

Select the *Grid lines* option to add grid lines to the axes in the graph. Once the graph is created, modify the grid line properties by selecting an axis and clicking the **Property Manager**Line page.

Math Plot

Select the *Math plot* option to add a math plot to the graph.

Color Palette

The *Color palette* sets the line, fill, and/or symbol colors for the plots in the graph. The colors are selected from the color gradient in the *Color palette* field and applied to each plot. The first plot receives the color associated with the left-most node in the color gradient. The last plot receives the color associated with the right-most node in the color gradient. The remaining plots are distributed equally across the color gradient in order by plot number.

Select a new predefined color gradient by clicking the current *Color palette* and selecting a color gradient in the list. Modify, create, load, or save a color gradient in the Color Gradient dialog by clicking the  button.

Template Graphs

Template graphs are used to store graphing preferences in **Grapher**. When a template file is saved it does not contain a reference to any data file. This means that once the template graph is created, you can use the template to create a new graph with any compatible data set.

Creating a Template

To create a new template:

1. In the plot window, design the graph exactly the way you want the final graph to appear. Create any plot type, set the axes properties, add titles, format legends, import images, add borders, or customize the graph in any way you prefer.
2. Click the **File | Save As** command.
3. In the **Save As** dialog, specify the directory and a *File name.*
4. Set the *Save as type* to *Plot Template (*.grt)*.
5. Click the *Save* button and the file is saved as a complete template file*.*

Creating a New Plot from a Template

To create a new plot from a template:

1. Click the **File | New | Plot from Template** command.
2. In the **Open** dialog, select a .GRT template file, and click the *Open* button.
3. When prompted, select the data file to use with the template.
4. Check the *Use this worksheet for remaining items* if all the plots in a template use the same worksheet.
5. Check the *Set columns* if you want to change the column specifications for individual plots in the graph.
6. Click the *Open* button and the new plot is created. The plot uses all the settings from the template and the specified data file.

Alternatively, you can open a template using the steps listed below in the *Editing a Template*section.

Editing a Template

To edit a template:

1. Click the **File | Open** command.
2. In the **Open** dialog, select the .GRT template file and click the *Open* button.

3. When prompted, select the data file(s) to use with the template and click the *Open* button.
4. Check the *Use this worksheet for remaining items* if all the plots in a template use the same worksheet.
5. Check the *Set columns* if you want to change the column specifications for individual plots in the graph.
6. Click the *Open* button and the template is loaded with the specified data set.
7. After the template file appears, make any desired changes.
8. Choose **File | Save** to save the updated template file.

Tips About Templates

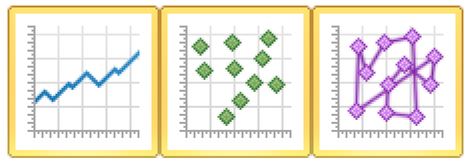
- There are few restrictions on data types that can be used in a template. The axes limits change to accommodate the new data set if the *Auto* box is checked for axis minimum and maximum. If the data set cannot be used with the template, i.e., log axis with negative data, an error message appears.
- If an empty plot appears after the data set is selected, check the plot's plot properties on the **Plot** page of the Property Manager. Make sure the selected data columns contain numeric data. Also, check the axes limits to see if they have been set beyond the data range.
- To save the file with a reference to a specific worksheet, click the **File | Save As** command and set the *Save as type* to *Grapher File (*.grf)*.
- To save the file with the worksheet data embedded in the file, click the **File | Save As** command and set the *Save as type* to *Grapher Project (*.gpj)*.
- Templates can use multiple data files or multiple data columns. To use one worksheet for all plots, check the *Use this worksheet for remaining items* box when selecting data files. When using the Open method in automation, the template only uses one worksheet or grid file.
- Check the *Set columns* box to display the Select Columns dialog and select the data columns to use in the graph. If you have more than one plot in the template, make sure *Use this worksheet for remaining items* is not enabled so you can select the columns for each plot separately.
- When opening a template, all references to worksheets, including linked text, will cause a prompt to select the data file. If all worksheet references are to the same worksheet, check the *Use this worksheet for remaining items* box.

Template Alternatives

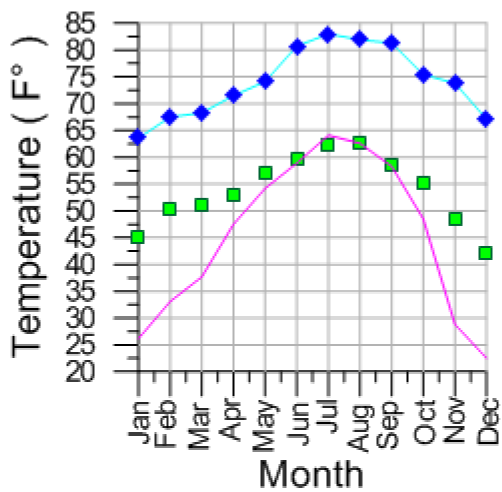
- Click the File | Options command to set default settings such as line, fill, symbol, and font properties.
- Click the File | Defaults command to set default settings for basic objects, graphs, plots, maps, axes, and legends.
- If a graph is saved as a *Grapher File (*.grf)* or *Grapher Project (*.gpj)*, you can still use it as a "template." To do so, open the graph as normal using the **File | Open** command. Then, Select the plot and click the **Plot** tab in the **Property Manager**. Change the columns used to create the plot or click the *Worksheet* button to change the data used to create the plot.

Line, Scatter, and Line/Scatter Plots

The **Home | New Graph | Basic | Line Plot**, **Home | New Graph | Basic | Scatter Plot**, and **Home | New Graph | Basic | Line/Scatter Plot** commands create a line, scatter, or line and scatter plot from a data file. The data is displayed as a line, as symbols, or as a combination of a line and symbols. The data are plotted in the order in which they appear in the data file. You can have multiple line/scatter plots in a graph. In addition, the plots can contain fit curves, error bars, labels, and color fill. You can also clip the curves.



Click the **Line Plot**,**Scatter Plot**, *or* **Line/Scatter Plot** *buttons to create the desired plot type.*



Line/Scatter plots show data as lines, lines and symbols, or only symbols. This graph has three plots: a pink line only plot, a green symbol only plot, and a blue line and symbol plot.

Creating a New Line, Scatter, or Line/Scatter Plot

To create a new line, scatter, or line/scatter graph:

1. Click the **Home | New Graph | Basic | Line Plot, Home | New Graph | Basic | Scatter Plot,** or **Home | New Graph | Basic |**

Line/Scatter Plot command.

2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A line, scatter, or line/scatter plot is created using the default properties.

Editing an Existing Line, Scatter, or Line/Scatter Plot

To change the features of a line, scatter, or line/scatter plot, click once on the plot in either the plot window or the Object Manager to select it. The properties of the selected line/scatter plot are displayed in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

Error Bars

Labels

Symbol

Line

Fill

Graph Properties

The graph properties contain the following pages in the **Property Manager**.

Title

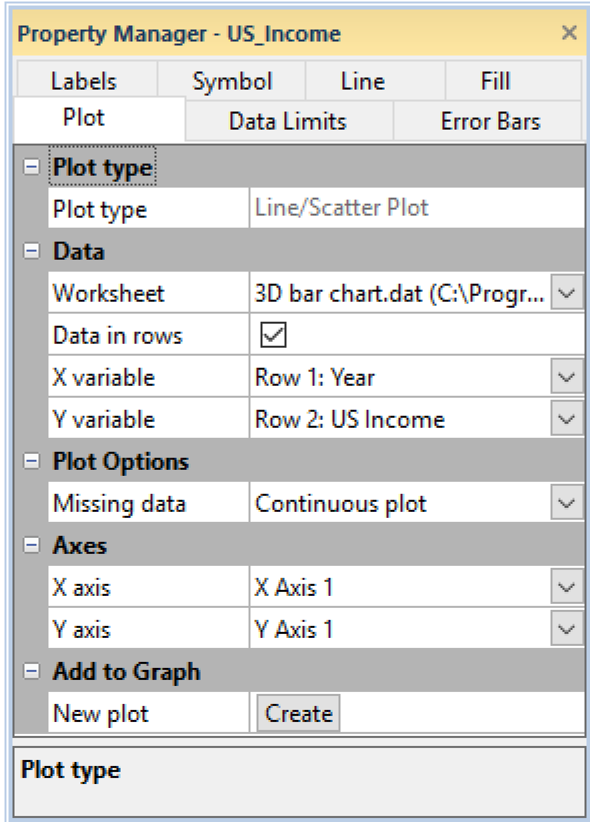
Line

Fill

3D Settings

Plot Page - Line, Scatter, and Line/Scatter Plots

The line, scatter, and line/scatter plot properties **Plot** page contains the options to change the data file and axes; create fit curves in the plot; and add a new plot to the graph. To view and edit line/scatter plot properties, click on the line/scatter plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the line/scatter plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *Y column*, and *Z column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

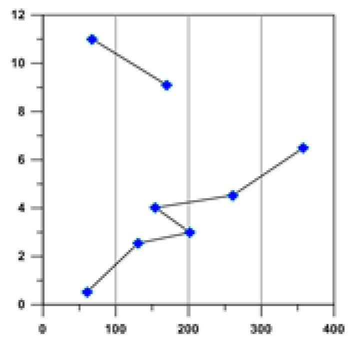
- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

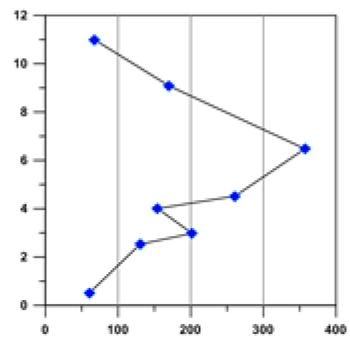
NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Missing Data

Rows containing text or blanks in the plotted columns are ignored and are not plotted on the graph. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set. Data filtered using the *Criteria* settings are not included as missing data. *Missing data* is not available for all plot types.



This plot has the Missing data *option set to* Discontinuous plot*. The line breaks across the missing data point.*



This plot has the Missing data *option set to* Continuous *plot. The line continues and does not break across the missing data point.*

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

3D Settings

The *3D Settings* section is displayed for an XYZ line/scatter plot and includes options for displaying drop lines and plot projections.

Drop Lines

3D XYZ plots have vertical, horizontal, and Z drop line options. When the box next to the *Vertical drop lines* option is checked, lines are drawn from the points to the bottom wall (XZ plane). When the box next to the *Horizontal drop lines* option is checked, lines are drawn from the point to the side wall (YZ plane). When the box next to the *Z drop lines* option is checked, lines are drawn from the point to the back wall (XY plane).

Drop Axis

When the *Vertical drop lines* or *Horizontal drop lines* box is checked, you can choose the plane to which the lines are drawn. Drop lines are drawn from the data point to the plane that intersects the drop axis minimum.

- For vertical drop lines, the XZ plane to which the drop lines are drawn is specified by the *Vert drop axis* minimum location.
- For horizontal drop lines, the YZ plane to which the drop lines are drawn is specified by the *Horz drop axis* minimum location.
- Z drop lines are always drawn to the XY plane at the Z axis maximum. There is no Z drop axis property.

Click on the current axis name next to *Vert drop axis* or *Horz drop axis*. In the list, select the desired axis. The plot is automatically updated to show the lines from the points to this axis minimum.

Drop Line Frequency

If there are many drop lines, you can change the frequency the lines are drawn by entering a new number into the *Line frequency* box. For example, if *Linefrequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped. To change the *Line frequency*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the number of drop lines in the plot.

Drop Line Properties

The drop line properties can be individually controlled with the *Vert drop line properties*, *Horz drop line properties*, and *Z drop line properties* sections on the Line page. Click the next to the appropriate section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the drop lines.

Projection Lines

Projection lines are also available for 3D XYZ plots. Projection lines are 2D representations of the 3D lines and appear on the various axis walls. Check the boxes next to the *Back projection*, *Side projection*, or *Bottom projection* options to add one, two, or all three of these projection lines to the graph. The *Back projection* option places the XY projection on the back wall of the graph. The *Side projection* option places the YZ projection on the side wall. The *Bottom* projection places the XZ projection on the bottom wall.

The projection line properties can be controlled in the *Projection line properties* section on the Line page. Click the ⊞ next to the *Projection line properties* section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the projection lines.

New Plot

Click the *Create* button next to the *New plot* command to create a new plot based on the current data file. A new plot is created using the same *X column* as the selected plot. The *Y column* changes to the next column in the worksheet that contains data. For example, if a selected line/scatter plot uses column A for the *X column* and column B for the *Y column*, clicking the *Create* button generates a new line/scatter plot with column A for the *X column* and column C for the *Y column*.

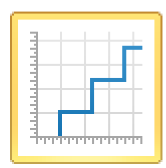
The new line/scatter plot is selected so you can change the new plot's properties. The line, fill, and/or symbol color automatically changes to a new color. The *Plot palette* option on the **Options** dialog Plots page controls the colors for plots added via the *Create* button in the **Plot** page.

Fit Curves

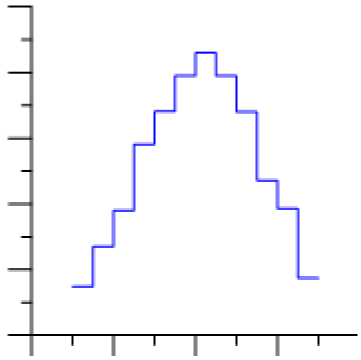
Click the **Home | Add to Graph | Fit Curve** command to add a fit curve to the graph. This adds a linear fit by default. Many fit types are available.

Step Plots

Click the **Home | New Graph | Basic | Step Plot** command to create a step plot. Step plots are very similar to line/scatter plots. In line/scatter plots, the connecting line is drawn directly between adjacent points using the shortest path. In a step plot, the connecting lines are always drawn parallel or perpendicular to the axes.



Click the **Step Plot** *button to create the step plot.*



Step plots draw data connecting lines as parallel or perpendicular to an axis.

To understand how this line is created, imagine drawing a horizontal line through each data point, then go back and draw a vertical line through each data point. The intersecting lines would form the step plot. Of course, you could also start by drawing the vertical lines first, which creates a different step path. **Grapher** makes it easy to create plots with either horizontal or vertical step lines.

Creating a New Step Plot

To create a step plot:

1. Select **Graphs | Create | Basic | Step Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A step plot is created using the default properties.

Editing Step Plot Properties

To change the features of a step plot— including the columns used to create the plot— first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

Labels

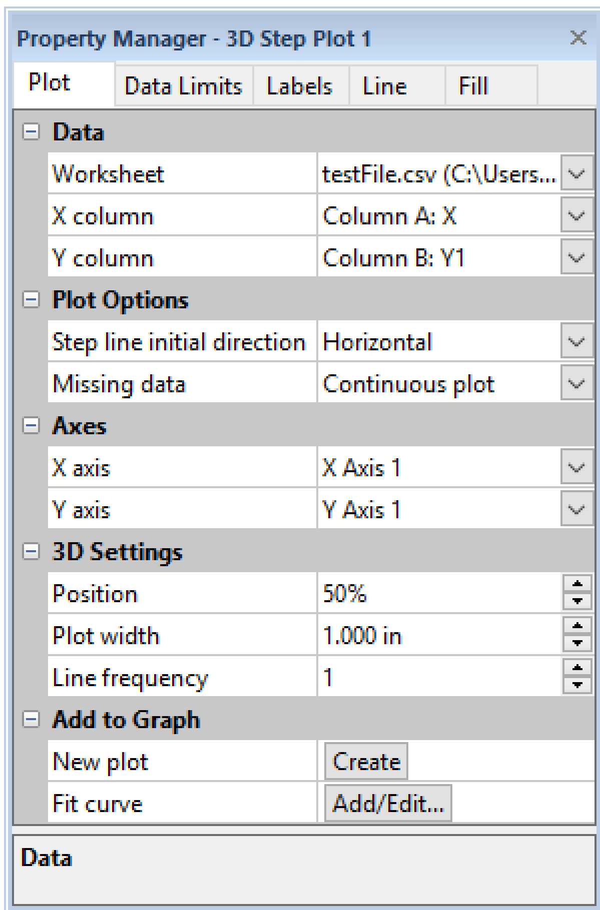
Symbol

Line

Fill

Plot Page - Step Plots

The step plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; choose how step lines are drawn; create fit curves in the plot; and add a new plot to the graph. To view and edit step plot properties, click on the step plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the step plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column* or *Y column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

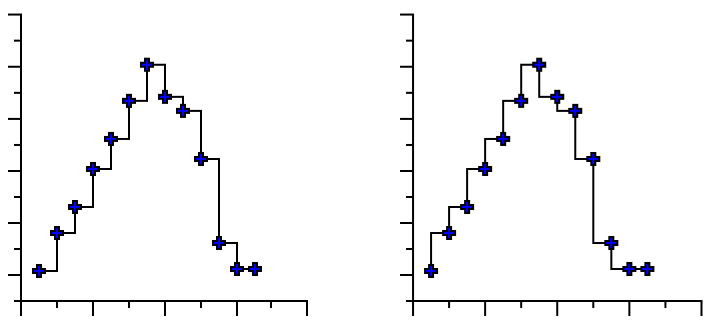
- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Step Lines

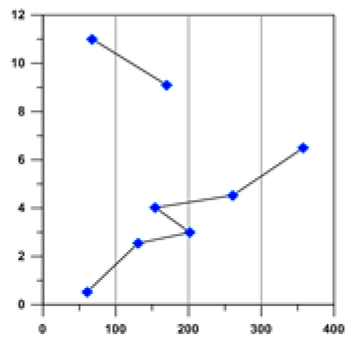
The *Step line initial direction* option determines how the step line is drawn between any two adjacent points. When *Horizontal* is selected the step lines are drawn so that they leave each data point parallel to the X axis. When *Vertical* is selected the step lines are drawn so that they leave each data point parallel to the Y axis. To change the *Step line initial direction*, click on the current option. Select the desired method of drawing the lines from the list. The plot automatically updates.



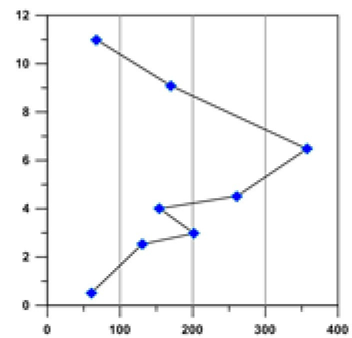
The plot on the left shows the step plot with the Step lines initial direction *set to* Horizontal*. The plot on the right is set to* Vertical*.*

Missing Data

Rows containing text or blanks in the plotted columns are ignored and are not plotted on the graph. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set. Data filtered using the *Criteria* settings are not included as missing data. *Missing data* is not available for all plot types.



This plot has the Missing data *option set to* Discontinuous plot*. The line breaks across the missing data point.*



This plot has the Missing data *option set to* Continuous *plot. The line continues and does not break across the missing data point.*

Change Axes

Click on the axis name next to the *X axis*, or *Y axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis* or *Y axis* lists.

3D Settings

The *3D Settings* section includes options for specifying the width, location, and number of lines in a 3D step plot.

Position

The *Position* option controls the location of the plot on the depth axis of the 3D plot. For example, 0 percent places the plot at the front of the graph, 100 percent places the plot at the back of the graph, and 50 percent places the plot in the middle of the graph. To change the position, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the  to increase or decrease the position of the plot.

Width

The *Plot width* controls the width of the plot. Plots can be 0.01 to 6 inches (0.025 and 15.24 cm) wide. To change the width, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the width of the plot.

Line Frequency

Use the *Line frequency* field to control the cross lines along the plot width. The lines are usually drawn at each data point over the width of the plot, that is *Line frequency* is set to 1. When there are many points on the graph, the line color may overwrite most of the ribbon fill color. Use the *Linefrequency* option to skip lines on the plot. For example, if *Line frequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped between lines. To change the *Line frequency*, click the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the number of cross lines in the plot.

New Plot

Click the *Create* button next to the *New plot* command to create a new plot based on the current data file. A new plot is created using the same *X column* as the selected plot. The *Y column* changes to the next column in the worksheet that contains data. For example, if a selected step plot uses column A for the *X column* and column B for the *Y column*, clicking *Create* generates a new step plot with column A for the *X column* and column C for the *Y column*.

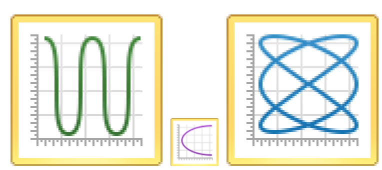
The new step plot is selected so you can change the new plot's properties. The line, fill, and/or symbol color automatically changes to a new color. The *Plot palette* option on the **Options** dialog Plots page controls the colors for plots added via the *Create* button in the **Plot** page.

Fit Curves

Click the **Home | Add to Graph | Fit Curve** command to add a fit curve to the graph. This adds a linear fit by default. Many fit types are available.

Function Plots

Click the **Home | New Graph | Basic | Y=F(X) Function Plot**, **Home | New Graph | Basic | X=F(Y) Function Plot**, or **Home | New Graph | Basic | Parametric Function Plot** command to display mathematical functions on a graph. Data

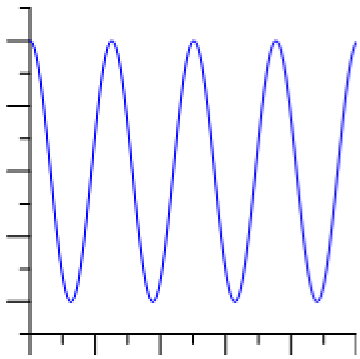


Click the **Y=F(X) Function Plot**, *the* **X=F(Y) Function Plot**, *or the* **Parametric Func-**

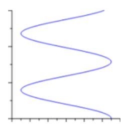
files are not required for this type of plot. You can plot Y as a function of X, plot X as a function of Y, or plot a parametric equation where X and Y are functions of a third variable, T. The X=F(Y) function plot is commonly used to create vertical lines in the plot, for example where X = F(Y) = 100.

tion Plot *buttons to create the function plots.*

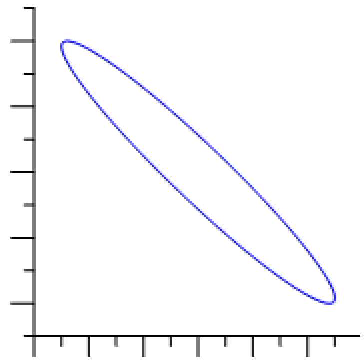
Regardless of the command clicked to create the plot, any 2D function plot can be changed to another 2D function type in the **Property Manager**.



*This 2D function plot displays the Y=F(X) function cos(2*X).*



This 2D function plot displays the X=F(Y) function cos(Y).



This 2D function plot displays the X=F(T), Y=G(T) parametric expression

X=cos(t-2), Y=sin(t+3).

Creating a New Function Graph

To create a function graph:

1. Click the **Home | New Graph | Basic | Y=F(X) Function Plot** command, the **Home | New Graph | Basic | X=F(Y) Function Plot**, or the **Home | New Graph | Basic | Parametric Function Plot** command.
2. A function plot is created using a default equation.

When plotting a function with discontinuity, for example plotting Y=1/X from -10 ≤ X ≤ 10, we recommend the following settings:

- Set the Plot page *Missing data* property to *Discontinous plot*.
- Set the axes limits to fixed custom values. Otherwise the axes may

scale to extreme values automatically.

- Experiment with the Data Limits page *Number of points* property to ensure the function plot displays as desired. With the Y=1/X example from above where both X and Y axes range between -10 and 10, a *Number of points* value of 201 extends the function plot across the entire graph, while a *Number of points* value of 199 does not.

Editing Function Plot Properties

To change the features of a function plot — including the equations used to create the plot — first select the function plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

Labels

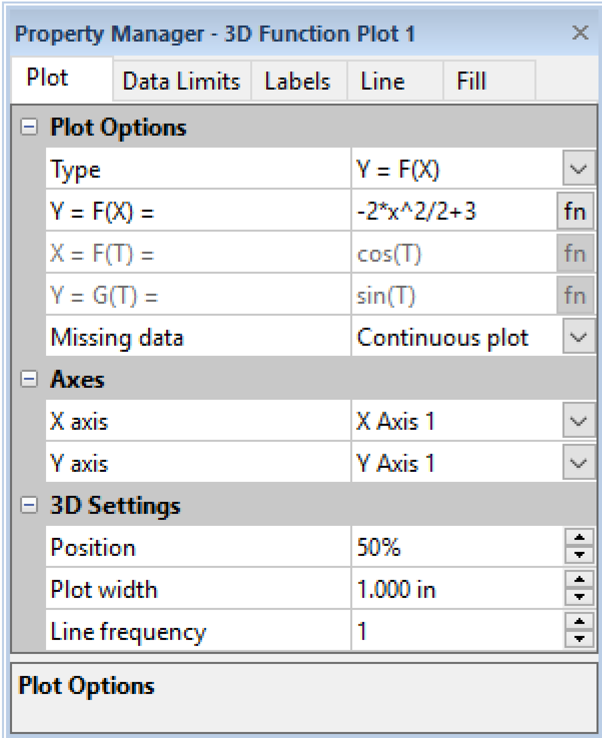
Symbol

Line

Fill

Plot Page - Function Plots

To view and edit function plot properties, click on the function plot in the Object Manager or plot window to select it. Click the **Plot** tab in the Property Manager. You can change the axes and set equations and function intervals for the function plot or 3D function plot.



*Click on the **Plot** tab in the **Property Manager** to edit the plot properties for the function plot.*

Plot Type

The *Plot type* property displays the type of plot.

Type

The *Type* option determines if the plot is created with a set of equations or a single equation. When the *Type* field is set to *Y = F(X)*, functions are entered in the form Y as a function of X in the *Y = F(X)*= field. When the *Type* field is set to *X = F(Y)*, functions are entered in the form X as a function of Y in the *X = F(Y)*= field. If *Type* is set to *Parametric*, enter X and Y as functions of T in the *X = F(T)*= and *Y = G(T)*= fields.

Function

Enter the function equation in the *Y = F(X)* = or *X = F(Y)* = box. The form of the function updates automatically with the *Type* selection. To change the equation, highlight the existing equation. Type a new equation in the box. Press ENTER on the keyboard to make the change.

For parametric equations, enter the X portion of the equation in the *X=F(T)* = box. Enter the Y portion of the equation in the *Y=F(T)* = box. To change the equation, highlight the existing equation. Type a new equation in the box. Press ENTER on the keyboard to make the change.

In both cases, you can click the fn button to open the Functions dialog and add predefined mathematical functions to the equation or you can type the functions into the fields manually.

Missing Data

When the function and value limits settings results in an undefined value, e.g. 1/0 or ln(-1), the value is not plotted. These undefined points are treated as missing data. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

3D Settings

The *3D Settings* section includes options for specifying the width, location, and number of lines in a 3D function plot.

Position

The *Position* option controls the location of the plot on the depth axis of the 3D plot. For example, 0 percent places the plot at the front of the graph, 100 percent places the plot at the back of the graph, and 50 percent places the plot in the middle of the graph. To change the position, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the position of the plot.

Width

The *Plot width* controls the width of the plot. Plots can be 0.01 to 6 inches (0.025 and 15.24 cm) wide. To change the width, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the width of the plot.

Line Frequency

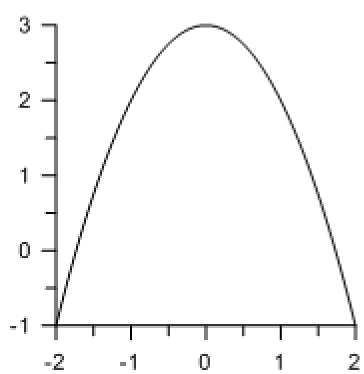
Use the *Line frequency* field to control the cross lines along the plot width. The lines are usually drawn at each data point over the width of the plot, that is *Line frequency* is set to 1. When there are many points on the graph, the line color may overwrite most of the ribbon fill color. Use the *Linefrequency* option to skip lines on the plot. For example, if *Line frequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped between lines. To change the *Line frequency*, click the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the number of cross lines in the plot.

Example 1

To create a plot using the equation:

$Y = 3 - x^2$

1. Select a function plot.
2. Click the **Plot** tab in the Property Manager to access the *Plot Properties* page.
3. Set *Type* to *Y = F(X)*.
4. Highlight the contents of the *Y = F(X)=* box and then type 3 - x^2.
5. Move your cursor to the end of the equation and press ENTER on your keyboard. The equation is drawn on the graph.



This function plot is the result of the parametric equation listed in example 1.

Example 2

To create a plot using the equation:

X = 2t

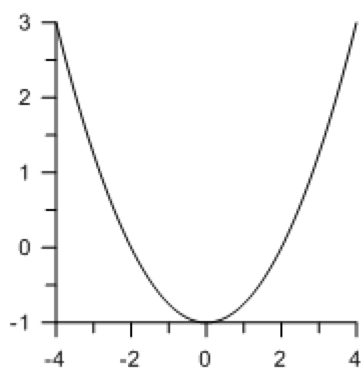
Y = t2 - 1

-2 ≤ 0 ≤ 2

1. Select a function plot.
2. Click the **Plot** tab in the Property Manager to access the *Plot Properties* page.
3. Set *Type* to *Parametric*.
4. Highlight the contents of the *X = F(T)=* field and enter 2*T.
5. Highlight the contents of the *Y = G(T)=* field and click the fn button to the right of the equation box.
6. In the Functions dialog, select *POW(X,Y)* from the function list.
7. Click the *Insert* button in the **Functions** dialog.
8. Replace X,Y in POW(X,Y) with T,2.
9. After POW(T,2) type -1. Your equation in the Y=G(T)= field should appear like this:

   POW(T,2)-1

10. Enter -2 in the *First value* field.
11. Enter 2 in the *Last value* field.



This function plot is the result of the parametric equation listed in example 2.

Create Vertical Lines in a Graph

The XY Function Plot can be used to easily plot vertical lines in a graph. A vertical line can be plotted as a function of the form X = F(Y) = C, where C is a constant value.

This example will demonstrate plotting two vertical lines on the *step plot.-grf* sample file and adding a fill between the plots.

Creating XY Function Plots

The following process demonstrates how to create two vertical lines with XY function plots.

1. Click the **File | Open** command.
2. In the **Open** dialog, select the *step plot.grf* sample file and click *OK*. The step plot sample file is located at C:\Program Files\Grapher 15\Samples\step plot.grf by default.
3. Select *Graph 1* in the **Object Manager**.
4. Click the **Home | Add to Graph | Plot** command.
5. In the **Select Plot Type** dialog, select *Function Plot* and click *OK*.
6. Click *OK* in the **Choose Axes**dialog.
7. Select *Function Plot 1* in the **Object Manager**.
8. Click the **Plot** tab in the **Property Manager**.
9. Change the *Type* to *X = F(Y)*.
10. Change the *X = F(Y) =* value to *8*.
11. Change the *Last value* to the Y axis maximum, that is *160*.
12. Click the **Home | Add to Graph | Plot** command.
13. In the **Select Plot Type** dialog, select *Function Plot* and click *OK*.
14. Click *OK* in the **Choose Axes**dialog.
15. Select *Function Plot 2* in the **Object Manager**.
16. Click the **Plot** tab in the **Property Manager**.
17. Change the *Type* to *X = F(Y)*.
18. Change the *X = F(Y) =* to another constant, such as *12*.
19. Change the *Last value* to *160* (the Y axis maximum).

After completing the steps above, vertical lines plotted at X = 8 and X = 12 have been added to the step plot graph.

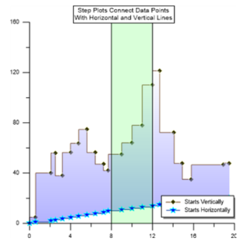
Add a Between Fill

The following steps demonstrate how to add a fill between the two XY function plots.

1. Select *Graph 1* in the **Object Manager**.
2. Click the **Between Fill** tab in the **Property Manager**.
3. Click the *Add* button in the *Add fill* field. *Fill 2* will be added to the *Fills* list.
4. In the *Plot one* list select *Function Plot 1*.

5. In the *Plot two* list select *Function Plot 2*.
6. In the *Fill style* section, change the *Direction* to *Horizontal*.

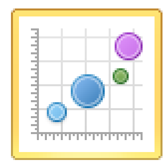
A between fill is added to the graph between the vertical lines. Notice by default the fill uses the same properties as the existing between fill.



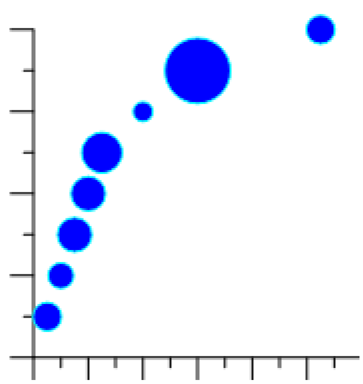
Function plots were used to create vertical lines at X=8 and X=12.

Bubble Plots

Click the **Home | New Graph | Basic | Bubble Plot** command to display two variables on a scatter-type plot. In a 2D bubble plot, the diameter of each bubble can vary in size, providing a way to represent an additional dimension of data. For example, consider a traditional [scatter plot]() that shows the number of new automobile sales in the U.S. over a period of time. Using a 2D bubble plot, you could also display a third dimension of data that shows the average U.S. household income over the same time span.



Click the ***Bubble Plot*** *button to create the bubble plot.*



Bubble plots show X, Y, and Z variables. The Z variable is displayed as the bubble size.

Creating a New Bubble Plot

To create a bubble plot:

1. Click the **Home | New Graph | Basic | Bubble Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A bubble plot is created using the default properties.

Editing Bubble Plot Properties

To change the features of a bubble plot— including the columns used to create the plot— first select the bubble plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

Labels

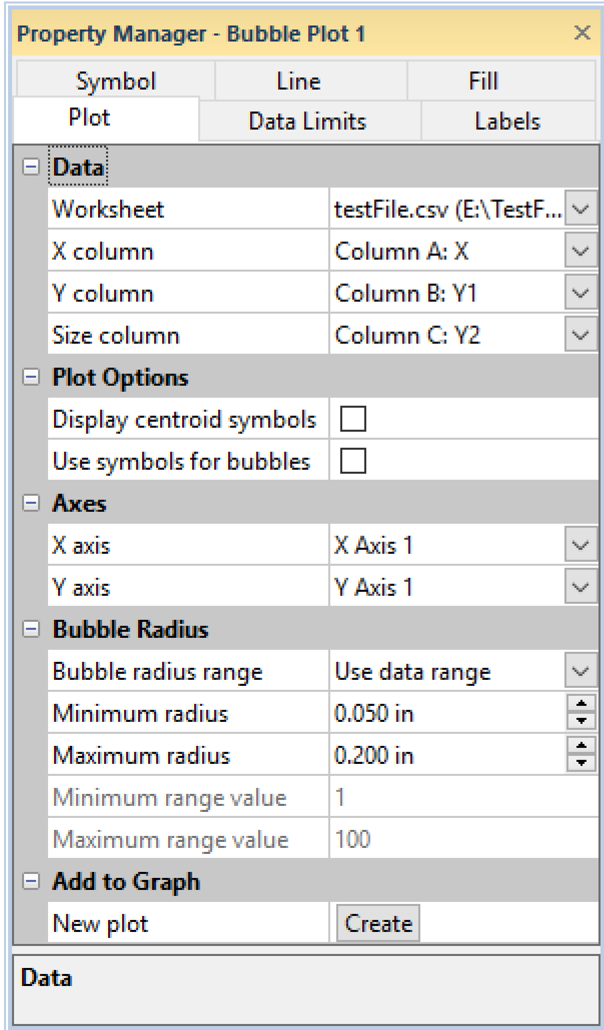
Symbol

Line

Fill

Plot Page - Bubble Plots

The bubble plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; set bubble properties; and add a new plot to the graph. To view and edit bubble plot properties, click on the bubble plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



Change the bubble plot properties in the ***Property Manager*** *on the* ***Plot*** *tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the**Open Worksheet**dialog, and click the*Open*button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click

on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *Y column*, *Z column, Size column,* and *Color column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

With 2D bubble plots, the *Z column* is used as the bubble size. In 3D XYZ bubble plots, the *Z column* is a dimension and the *Size column* controls bubble size. In ternary bubble plots, the *Size column* controls the bubble size. The *Color column*determines the color of the 3D XYZ bubbles.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

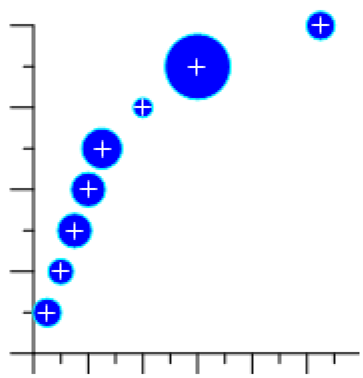
When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a

numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Bubble Centroids

The centroid location for each bubble can be displayed as a symbol on 2D bubble plots. This symbol is not scaled, and sometimes it is easier to distinguish overlapping bubbles when the centroid is visible. Check the box next to the *Display centroid symbols* to show the X, Y location of the data point as a symbol. Click the ⊞ next to *Centroid symbol* to set the centroid symbol properties.



Symbols can be displayed on the bubble's X, Y location.

Bubble Symbol

By default, the symbols in the bubble plot are open circles. The bubble line and fill color are set on the Line tab and Fill tab in the Property Manager.

Symbols other than scaled circles can be used for bubbles. To change the scaled symbol, check the box next to the *Use symbols for bubbles* option. You can change the symbol properties by clicking the ⊞ next to *Bubble symbol*.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

Fixed Value Based Bubble Radius Range

There are two ways to define the bubble radius range, using a fixed range or using a data range. Next to the *Bubble radius range*option, select *Use fixed range* to set the radius range based on user-defined data values. Use this method when you have multiple data sets in a similar range and would like to have the same data values represented by the same bubble size with each plot.

When the *Bubble radius range* is set to *Used fixed range*, enter a *Minimum data value* and *Maximum data value*. The *Minimum data value* is assigned to the *Minimum radius* size, the *Maximum data value* is assigned to the *Maximum radius* size. Each bubble's radius is then calculated by the bubble’s data value and where it falls between the minimum and maximum data values.

To change the *Minimum data value* or *Maximum data value*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. The *Minimum data value* and *Maximum data value* are in *Z column* units for a 2D bubble plot and *Size column*units for a 3D XYZ bubble plot.

To change the *Minimum radius* or *Maximum radius* values, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the size. The *Minimum radius*and*Maximum radius*values are in page units.

Data Based Bubble Radius Range

Set the *Bubble radius range* option to *Use data range* to automatically use the data's minimum and maximum values for determining bubble size. With this method, the smallest value in the *Z column* for 2D bubble plots or the *Size column* 3D XYZ bubble plots is displayed as the *Minimum radius* value. The largest value in the *Z column* for 2D bubble plots or the *Size column* for 3D XYZ bubble plots is displayed as the *Maximum radius* value. Intermediate values are displayed proportionally between these two values.

To change the *Minimum radius* or *Maximum radius* values, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the size. The *Minimum radius* and *Maximum radius* values are in page units.

Radius Formula

The formula used for bubble size by both methods is:

Br = ((Z - Zmin)/(Zmax - Zmin)) * (Rmax - Rmin) + Rmin

where:

Br	bubble radius
Z	bubble data value
Zmin	minimum data value with *Use data range*; *Minimum data value* with *Use fixed range*
Zmax	maximum data value with *Use data range*; *Maximum data value* with *Use fixed range*
Rmin	Minimum radius
Rmax	Maximum radius

When using the *Use data range* method, the *Minimum radius* is the smallest bubble ever drawn. Similarly, the *Maximum radius* is the largest bubble ever drawn. When using the *Use fixed range* method, the bubble radii may be smaller or larger than the *Minimum radius* or *Maximum radius* sizes should any bubble’s data value be either smaller or larger than the *Minimum data value* or *Maximum data value* entries.

3D Settings

The *3D Settings* section is displayed for an XYZ bubble plot and includes options for displaying drop lines and modifying 3D bubble appearance.

Drop Lines

3D XYZ plots have vertical, horizontal, and Z drop line options. When the box next to the *Vertical drop lines* option is checked, lines are drawn from the points to the bottom wall (XZ plane). When the box next to the *Horizontal drop lines* option is checked, lines are drawn from the point to the side wall (YZ plane). When the box next to the *Z drop lines* option is checked, lines are drawn from the point to the back wall (XY plane).

Drop Axis

When the *Vertical drop lines* or *Horizontal drop lines* box is checked, you can choose the plane to which the lines are drawn. Drop lines are drawn from the data point to the plane that intersects the drop axis minimum.

- For vertical drop lines, the XZ plane to which the drop lines are drawn is specified by the *Vert drop axis* minimum location.
- For horizontal drop lines, the YZ plane to which the drop lines are drawn is specified by the *Horz drop axis* minimum location.
- Z drop lines are always drawn to the XY plane at the Z axis maximum. There is no Z drop axis property.

Click on the current axis name next to *Vert drop axis* or *Horz drop axis*. In the list, select the desired axis. The plot is automatically updated to show the lines from the points to this axis minimum.

Drop Line Frequency

If there are many drop lines, you can change the frequency the lines are drawn by entering a new number into the *Line frequency* box. For example, if *Linefrequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped. To change the *Line frequency*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the number of drop lines in the plot.

Drop Line Properties

The drop line properties can be individually controlled with the *Vert drop line properties*, *Horz drop line properties*, and *Z drop line properties* sections on the Line page. Click the next to the appropriate section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the drop lines.

Draw Method and Color

There are three methods for drawing 3D bubbles. Next to the *Draw method* property, select *Wire frame 1*, *Wire frame 2*, or *Gradient fill*. To change the *Draw method*, select the current method and select the desired method from the list.

The wire frame methods draw lines on the bubbles. The line color and opacity is controlled on the Line page, and the background fill color and opacity is controlled on the Fill page. To change the *Line color* or *Fill color*, click on the existing color. In the list, select the new desired color. The *Line opacity* and *Fill opacity* control the amount of transparency for the wire frame lines and fill colors. To change the *Line opacity* or *Fill opacity*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the opacity.

The number of lines drawn on the bubbles is determined by the *Wireframe line count* property. You can draw between 10 and 100 lines on each bubble. The *Wireframe line count* field is only available when one of the wire frame methods is selected. To change the *Wireframe line count* , highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the line count.

When the *Draw method* is set to *Gradient fill*, the bubble is drawn with a color gradient across the bubble. Select or edit the color gradient *Colormap* on the Fill page. When using gradient fill, the *Gradient detail* option is also available. The *Gradient detail* determines how finely the gradient is drawn. You can set the *Gradient detail* between 10 and 1000. Lower numbers draw the gradient coarsely and higher numbers draw the gradient smoothly. The higher the value, the longer it takes to refresh the graph. To change the *Gradient detail*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the gradient detail.

Rotation

Use the *Bubble X rotation* and *Bubble Y rotation* settings to rotate the bubbles in the X and Y directions. Rotation values are in degrees. A positive rotation in the *Bubble X rotation* rotates the bottom of the bubble forward toward the screen. A positive rotation in the *Bubble Y rotation* rotates the front of the bubble clockwise.

Lighting Properties

The *Lighting* section includes the lighting properties: style, direction, color, and shininess.

New Plot

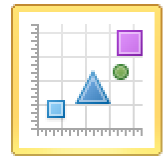
Click the *Create* button next to the *New plot* command to create a new plot based on the current data file. A new plot is created using the same *X column* and *Y column* as the selected plot. The *Size column* changes to the next column in the worksheet that contains data. For example, if a selected bubble plot uses column A for X values, column B for Y values, and column C for size values, clicking *Create* generates a new bubble plot with column A for X values, column B for Y values, and column D for size values.

The new bubble plot is selected so you can change the new plot's properties. The line, fill, and/or symbol color automatically changes to a new color for 2D bubble plots. The *Plot palette* option on the **Options** dialog

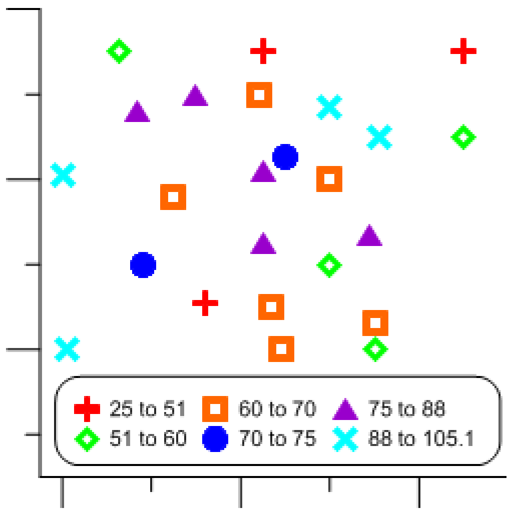
Plots page controls the colors for plots added via the *Create* button in the **Plot** page.

Class Scatter Plots

Click the **Home | New Graph | Basic | Class Scatter Plot** command to create a class scatter plot. A class scatter plot is a scatter plot with symbols for each XY location based on a required third value (*Class* column). Class scatter plots group data into discrete classes (bins). The data points are displayed using the symbol assigned to the class. Class scatter plots include a legend by default.



Click the **Class Scatter Plot** *button to create a class plot.*



The location of each of the class plot's XY data points is based on the Class *value.*

Creating a New Class Scatter Plot

To create a class scatter plot:

1. Click the **Home | New Graph | Basic | Class Scatter Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A class scatter plot is created using the default properties.

Editing Class Scatter Plot Properties

To change the features of a class scatter plot— including the column used to control the class— first select the class scatter plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

Labels

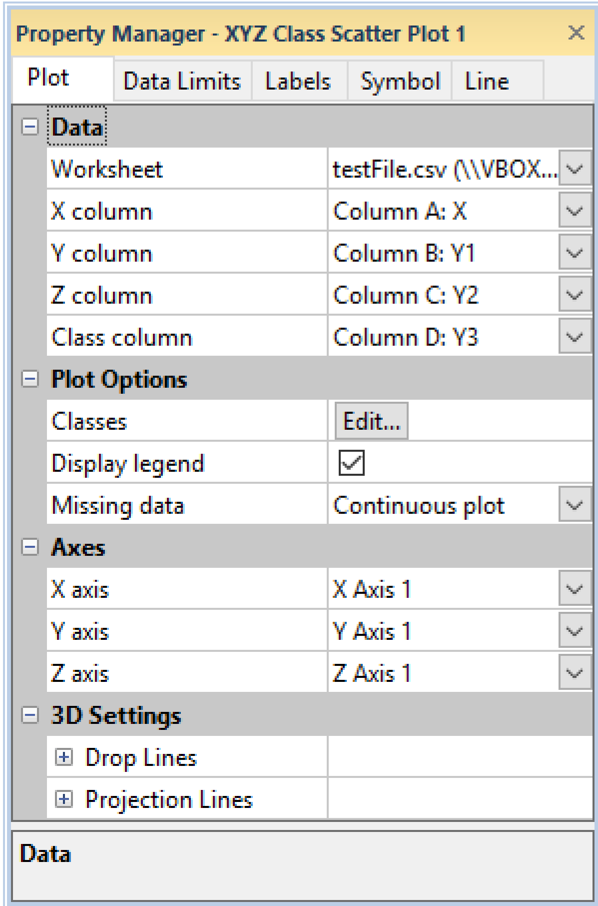
Symbol

Line

Fill

Plot Page - Class Scatter Plots

The class scatter plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; edit the classes used for the plot, and display the legend. To view and edit class scatter plot properties, click on the class scatter plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the class scatter plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column* and *Y column* or *Z column* (XYZ class scatter plot and Ternary class scatter plot only), *Radius column* (polar class scatter only), *Direction column* (polar class scatter only), and *Class column* fields. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

Note that the value in neither the *Row number* or *Sequence number* can be used in the *Class column*. The *Row number* and *Sequence number* cannot be used for any columns in a ternary class scatter plot.

When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Labels will automatically be unchecked to match the new data.

When the *Class column* includes only numeric values, a default number of classes is automatically created and all data points are displayed in one of the classes. When the *Class column* includes one or more text strings, the class*Method* is set to *Name* and the number of classes matches the number of unique text strings. Numbers are treated as text when the class method is set to *Name*.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Classes

Click the *Edit* button next to *Classes* to launch the Edit Classes dialog, which allows you to edit class information.

Display Legend

Check the box next to the *Display legend* option to make the class scatter plot legend visible. Clear the *Display legend* option to hide the legend. The legend display can also be changed in the **Object Manager** by checking or clearing the display box.

Class scatter plot legends cannot be copied and pasted. If you need to copy a class scatter plot legend, click on the legend to select it. Click the Detach Legend command to break the legend apart into multiple objects. The individual objects can be edited, but the link between the legend and the data is destroyed.

Missing Data

Rows containing text or blanks in the plotted columns are ignored and are not plotted on the graph. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set. Data filtered using the *Criteria* settings are not included as missing data. *Missing data* is not available for all plot types.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

Polar class scatter plot and ternary class scatter plot axes cannot be changed.

3D Settings

The *3D Settings* section is displayed for an XYZ class scatter plot and includes options for displaying drop lines and plot projections.

Drop Lines

3D XYZ plots have vertical, horizontal, and Z drop line options. When the box next to the *Vertical drop lines* option is checked, lines are drawn from the points to the bottom wall (XZ plane). When the box next to the *Horizontal drop lines* option is checked, lines are drawn from the point to the side wall (YZ plane). When the box next to the *Z drop lines* option is checked, lines are drawn from the point to the back wall (XY plane).

Drop Axis

When the *Vertical drop lines* or *Horizontal drop lines* box is checked, you can choose the plane to which the lines are drawn. Drop lines are drawn from the data point to the plane that intersects the drop axis minimum.

- For vertical drop lines, the XZ plane to which the drop lines are drawn is specified by the *Vert drop axis* minimum location.
- For horizontal drop lines, the YZ plane to which the drop lines are drawn is specified by the *Horz drop axis* minimum location.
- Z drop lines are always drawn to the XY plane at the Z axis maximum. There is no Z drop axis property.

Click on the current axis name next to *Vert drop axis* or *Horz drop axis*. In the list, select the desired axis. The plot is automatically updated to show the lines from the points to this axis minimum.

Drop Line Frequency

If there are many drop lines, you can change the frequency the lines are drawn by entering a new number into the *Line frequency* box. For example, if *Linefrequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped. To change the *Line frequency*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the number of drop lines in the plot.

Drop Line Properties

The drop line properties can be individually controlled with the *Vert drop line properties*, *Horz drop line properties*, and *Z drop line properties* sections on the Line page. Click the next to the appropriate section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the drop lines.

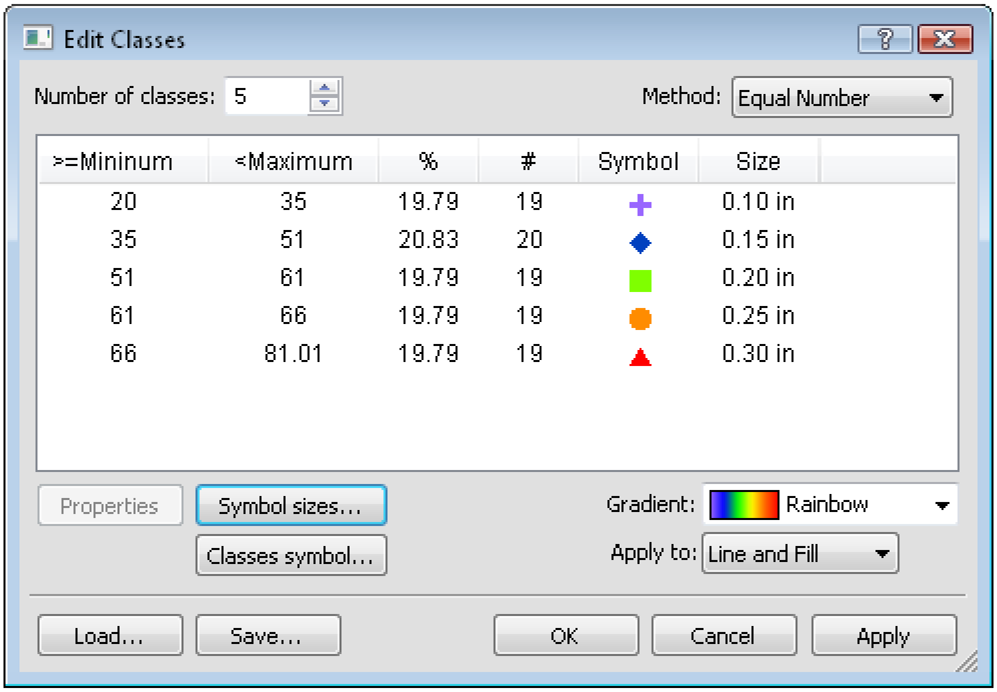
Projection Lines

Projection lines are also available for 3D XYZ plots. Projection lines are 2D representations of the 3D lines and appear on the various axis walls. Check the boxes next to the *Back projection*, *Side projection*, or *Bottom projection* options to add one, two, or all three of these projection lines to the graph. The *Back projection* option places the XY projection on the back wall of the graph. The *Side projection* option places the YZ projection on the side wall. The *Bottom* projection places the XZ projection on the bottom wall.

The projection line properties can be controlled in the *Projection line properties* section on the Line page. Click the next to the *Projection line properties* section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the projection lines.

Edit Classes Dialog

The **Edit Classes** dialog allows you to define the classes used to group the data values in a classed scatter plot. Each class is represented by a unique symbol in the class scatter plot. Click on a class scatter plot in the Object Manager or the plot window to select it. In the Property Manager, open the **Plot** page. Click the *Edit*button next to the *Classes* option to open the **Edit Classes** dialog, which allows you to edit class information.



*Use the **Edit Classes** dialog to define the classes used to group the data values.*

Number of Classes

The *Number of classes* value is used to specify how many classes or groupings should be on the plot. When you change the *Number of classes* value, the class list box is automatically updated to reflect the change. The *Number of classes* must be a whole number from 1 to 300. To change the value, highlight the existing value and type a new value or click the  to increase or decrease the value.

When the *Class column* is numeric, a default number of classes is automatically created and all data points are displayed in one of the classes. When the *Class column* is a text string, the number of classes matches the number of unique text strings in the column where an X and Y value exist.

When the *Number of classes* is increased when the *Method* is set to *Name*, a new text class is automatically added if the *Class column* has any additional text items that are not currently a *Class Name*. If there are no more unique text strings in the column, a blank class is created.

Method

The *Method* specifies the method used to calculate the limits of each class:

- *Equal Number* assigns the class ranges such that approximately an equal number of points are included in each class. In this case, the interval of each class is usually different.
- *Equal Intervals* assigns the class ranges so the interval between the *>=Minimum* value and the *<Maximum* value is equal for each class. In this case, different numbers of points are usually assigned to each class.
- *Custom* allows you to set the *>=Minimum* value and the *<Maximum* value for each class. This allows you to specify your own ranges for the classes. Ranges defined in this way do not have to be contiguous. To change the *>=Minimum* or *<Maximum* value for any class, double-click the value in the class list. In the **Properties** dialog, set the values and the symbol property. Click *OK* to return to the **Edit Classes** dialog.
- *Name* sets the method to use a text string. Each unique text string in the *Class column* is a separate *Class Name*. When the *Method* is set to Name, there is a *Class Name* option. Double-click on any text in the *Class Name* column to edit the class properties in the **Properties** dialog. The *Class Name* option can be edited to any desired text. Unique text identifiers are not case sensitive. So, One, one, and ONE are all in the same group. Numbers are treated as text when the *Method* is set to *Name*.

Class List Box

The class list box displays summary statistics and allows you to specify the properties for each class:

- The *>=Minimum* column specifies the lower limit for each class of data. You can click the *Properties* button or double-click the number for any of the classes and change the value in the **Properties** dialog. The minimum value is included in this class.
- The *<Maximum* column specifies the upper limit for each class of data. You can click the *Properties* button or double-click the number for any of the classes and change the value in the **Properties** dialog. The maximum value is not included in the class.
- The *Class Name* column specifies the individual text entries for each class of data. You can click the *Properties* button or double-click the text for any of the classes and change the text in the **Properties** dialog. All text with the same text string are included in the class. Unique text identifiers are not case sensitive. So, *One, one,* and *ONE* are all in the same group.
- The *%* column indicates the percentage of data points in the particular class. This value cannot be edited and is for informational purposes only.
- The *#* column indicates the number of points included in each class.

This value cannot be edited and is for informational purposes only.

- The *Symbol* column displays the symbol used for each class. To change a symbol or symbol property used for a particular class, click the *Properties* button or double-click the symbol and change the value in the **Properties** dialog.
- The *Size* column displays the size of the symbol used for each class. To change the size, used for a particular class, click the *Properties* button or double-click the size and change the value in the **Properties** dialog.

Symbol Sizes

Click the *Symbol sizes* button to open the Symbol Sizes dialog. The **Symbol Sizes** dialog allows the size of all classes to be changed at the same time or allows for an incremental size to be set.

Classes Symbol

Click the *Classes symbol* button to open the Properties dialog. Set the *Symbol*, *Symbol set*, *Fill*, and *Line* properties for the symbol for all classes. Click *OK* and all classes update to show the selected symbol. This is useful if the same symbol should be used, but a variable color or size should be used for all classes.

Apply Gradient

The Apply Gradient command and list applies a color gradient to the class symbol line and/or fill colors.

First, specify which properties are being colored: the line, fill, or both. Click the currently selected option next to the *Apply Gradient...* button and select the desired option from the list:

- *to line and fill* sets both the line and fill color for each symbol as determined by the gradient.
- *to line* sets only the line color by the gradient. The fill color is set by the class color.
- *to fill* sets only the fill color by the gradient. The line color is set by the class color.

Next, Click *Apply Gradient* to select the gradient in the Color Gradient dialog. Click the current selection next to *Gradient* to select a predefined gradient. Click the  button to create a custom gradient. The *Gradient* is applied across all of the classes. The first class uses the minimum color in the gradient. The last class uses the last color in the gradient. All other classes are selected based on an equal number of intervals across the gradient.

To set the class color to something other than a gradient, double-click on the symbol in the *Symbol* column and change the color in the **Properties** dialog.

Load

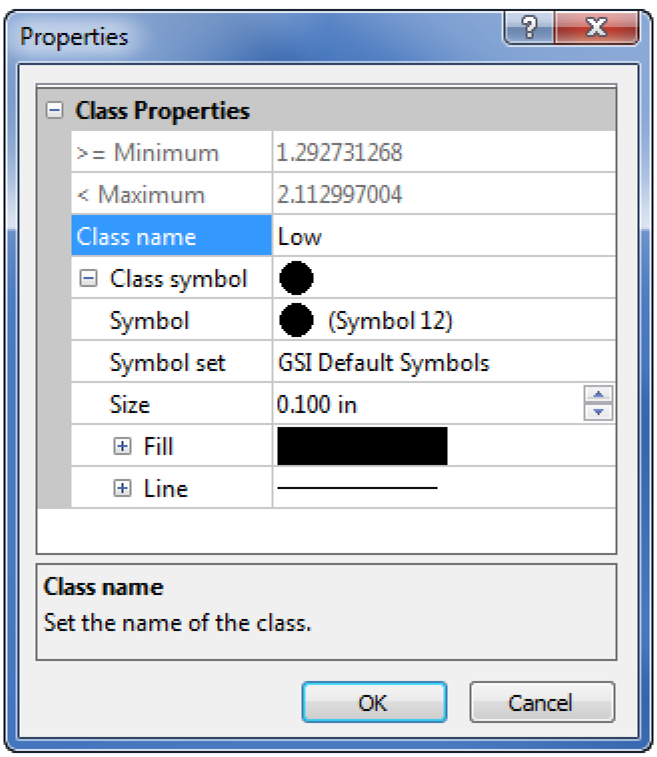
Click the *Load* button to open an existing classes .GCL file.

Save

Once all changes have been made in the **Edit Classes** dialog, click the *Save* button to save your entries as a new classes .GCL file.

Class Properties Dialog

The **Class Properties** dialog displays the properties for a class in a class scatter plot. The dialog is opened by clicking the *Properties* button in the Edit Classes dialog. The **Properties** dialog lists all of the properties for the selected class, including the *>=Minimum, <Maximum,Class name*, and *Class symbol* properties.



*The **Properties** dialog displays the properties for the selected class for a class scatter plot.*

>=Minimum

The *>=Minimum* value is the minimum value for the selected class. To change the minimum value, highlight the existing value and type a new number. Press ENTER on the keyboard to update the value. The minimum value is included in the class. This option is grayed out when the *Method* in the **Edit Classes** dialog is set to *Name*.

This option is not available when the *Classes symbol* button is clicked, as the symbol properties for all classes are set.

<Maximum

The *<Maximum* value is the maximum value for the selected class. To change the maximum value, highlight the existing value and type a new number. Press ENTER on the keyboard to update the value. The maximum value is not included in the class. This option is grayed out when the *Method* in the **Edit Classes** dialog is set to *Name*.

This option is not available when the *Classes symbol* button is clicked, as the symbol properties for all classes are set.

Class Name

The *Class name* option is grayed out when the *Method* in the **Edit Classes** dialog is set to *Equal Number, Equal Interval,* or *Custom*. The option is only available when the *Method* is set to *Name*. When available, the *Class name* displays the text associated with the text entry in the worksheet for this class. Capitalization is not important for the *Class name*. CLASS1 is the same as class1. Extra spaces or characters are important. So, class1 is not the same as class 1 or class1@. To change the text associated with any class, highlight the existing text and type the desired class text. The text displayed in the *Class name* is the same text displayed in the legend for this class.

This option is not available when the *Classes symbol* button is clicked, as the symbol properties for all classes are set.

Class Symbol

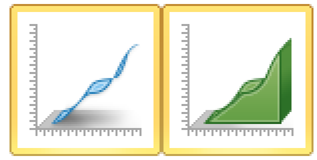
The *Class symbol* section contains the options to change the symbol properties for the selected class. The *Symbol, Symbol set, Size,* symbol *Fill* properties, and symbol *Line* properties options can be changed.

OK or Cancel

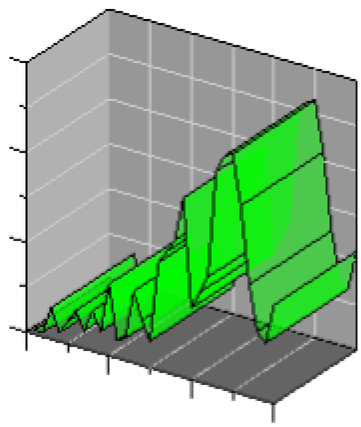
Click the *OK* button to accept the class changes. You are returned to the **Edit Classes** dialog. Click the *Cancel* button to return to the **Edit Classes** dialog without making the change.

3D Ribbon Plots and 3D Wall Plots

Click the **Home | New Graph | Basic | 3D Ribbon Plot** or **Home | New Graph | Basic | 3D Wall Plot** command to display 3D line plots. On a 3D ribbon plot or 3D wall plot, the data are plotted in the order in which it appears in the data file. You can have multiple ribbon and wall plots in a graph. In addition, the plots can contain fit curves, error bars, labels, and color fill.



Click the ***3D Ribbon Plot*** *or* ***3D Wall Plot*** *button to create a ribbon or wall plot.*



Ribbon plots are 3D versions of line/scatter plots with only two variables.

Creating a New 3D Ribbon Plot or 3D Wall Plot

To create a 3D ribbon or 3D wall plot:

1. Click the **Home | New Graph | Basic | 3D Ribbon Plot** or **Home | New Graph | Basic | 3D Wall Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A 3D ribbon plot or 3D wall plot is created using the default properties.

Editing 3D Ribbon Plot or 3D Wall Plot Properties

To change the features of a ribbon/wall plot— including the columns used to create the plot— first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

Error Bars

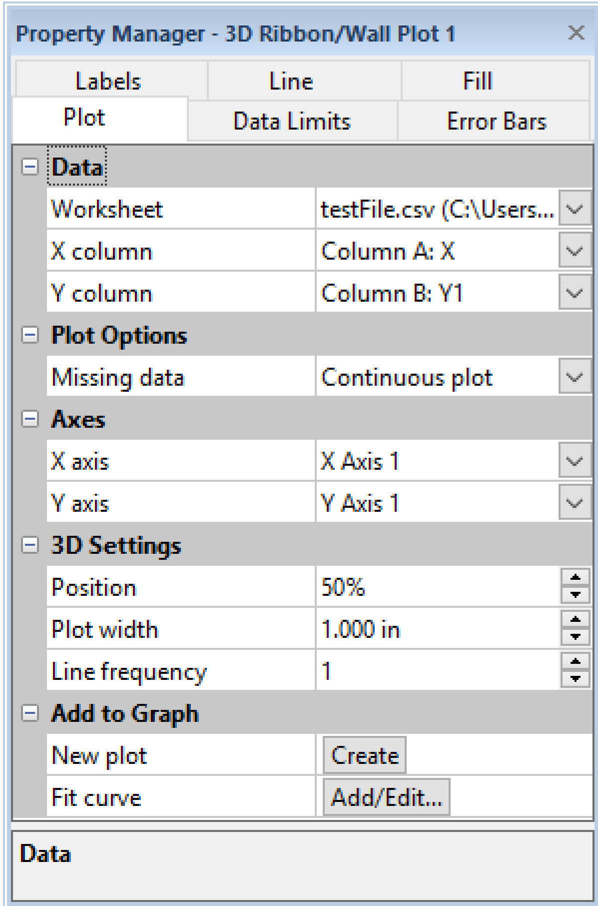
Labels

Line

Fill

Plot Page - Ribbon/Wall Plots

The ribbon/wall plot properties **Plot** page contains the options to change the data file and axes, create fit curves in the plot, and add a new plot to the graph. To view and edit ribbon/wall plot properties, click on the ribbon/wall plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



The 3D ribbon/wall plot properties are changed in the ***Property Manager*** *on the* ***Plot*** *tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *Y column*, and *Z column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Missing Data

Rows containing text or blanks in the plotted columns are ignored and are not plotted on the graph. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set. Data filtered using the *Criteria* settings are not included as missing data. *Missing data* is not available for all plot types.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

Position

The *Position* option controls the location of the plot on the depth axis of the 3D plot. For example, 0 percent places the plot at the front of the graph, 100 percent places the plot at the back of the graph, and 50 percent places the plot in the middle of the graph. To change the position, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the  to increase or decrease the position of the plot.

Width

The *Plot width* controls the width of the plot. Plots can be 0.01 to 6 inches (0.025 and 15.24 cm) wide. To change the width, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the  to increase or decrease the width of the plot.

Line Frequency

Use the *Line frequency* field to control the cross lines along the plot width. The lines are usually drawn at each data point over the width of the plot, that is *Line frequency* is set to 1. When there are many points on the graph, the line color may overwrite most of the ribbon fill color. Use the *Linefrequency* option to skip lines on the plot. For example, if *Line frequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped between lines. To change the *Line frequency*, click on the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the  to increase or decrease the number of cross lines in the plot.

New Plot

Click the *Create* button next to the *New plot* command to create a new plot based on the current data file. A new plot is created using the same *X column* as the selected plot. The *Y column* changes to the next column in the worksheet that contains data. For example, if a selected ribbon/wall plot uses column A for the *X column* and column B for the *Y column*, clicking *Create* generates a new ribbon/wall plot with column A for the *X column* and column C for the *Y column*.

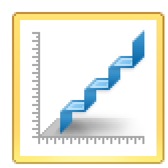
The new ribbon/wall plot is selected so you can change the new plot's properties. The line, fill, and/or symbol color automatically changes to a new color. The *Plot palette* option on the **Options** dialog Plots page controls the colors for plots added via the *Create* button in the **Plot** page.

Fit Curves

Click the **Home | Add to Graph | Fit Curve** command to add a fit curve to the graph. This adds a linear fit by default. Many fit types are available.

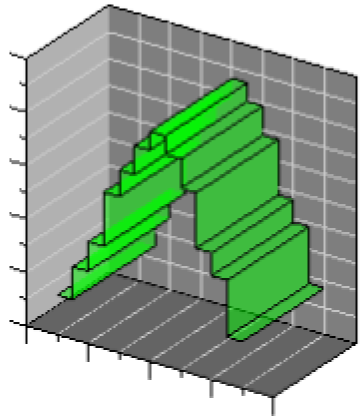
3D Step Plots

Click the **Home | New Graph | Basic | 3D Step Plot** command to create a 3D step plot. Step plots are very similar ribbon/wall plots. In ribbon/wall plots, the connecting line is drawn directly between adjacent points using the shortest path. In a step plot the connecting lines are always drawn parallel or perpendicular to the axes.



Click the ***3D Ribbon Step Plot*** *button to create a 3D step plot.*

To understand how this line is created, imagine drawing a horizontal line through each data point, then go back and draw a vertical line through each data point. The intersecting lines would form the step plot. Of course, you could also start by drawing the vertical lines first, which creates a different step path. **Grapher** makes it easy to create plots with either horizontal or vertical step lines.



This is an example of a 3D ribbon step plot.

Creating a New 3D Step Plot

To create a 3D ribbon step plot:

1. Click the **Home | New Graph | Basic | 3D Step Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A 3D ribbon step plot is created using the default properties.

Editing 3D Step Plot Properties

To change the features of a 3D ribbon step plot— including the columns used to create the plot— first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

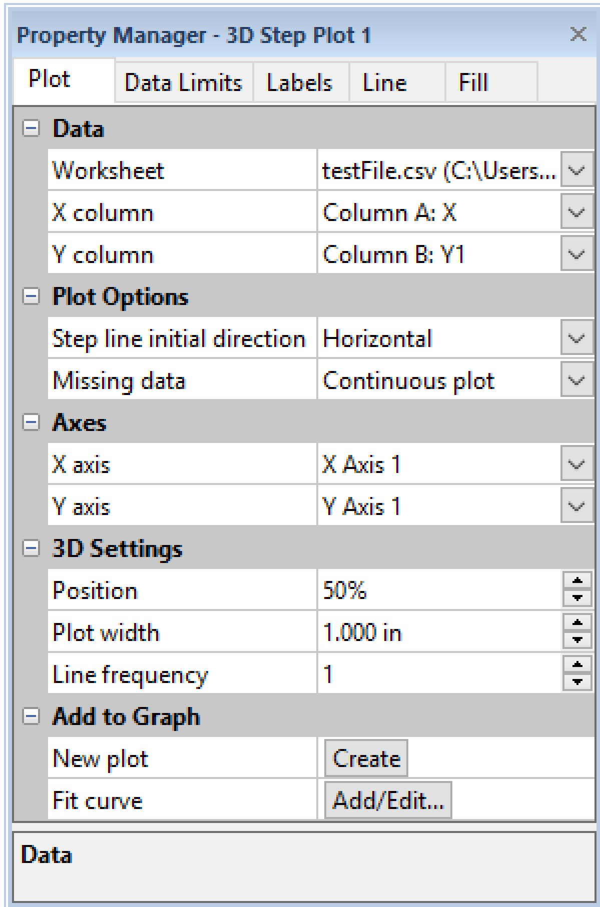
Labels

Line

Fill

Plot Page - Step Plots

The step plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; choose how step lines are drawn; create fit curves in the plot; and add a new plot to the graph. To view and edit step plot properties, click on the step plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the step plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column* or *Y column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

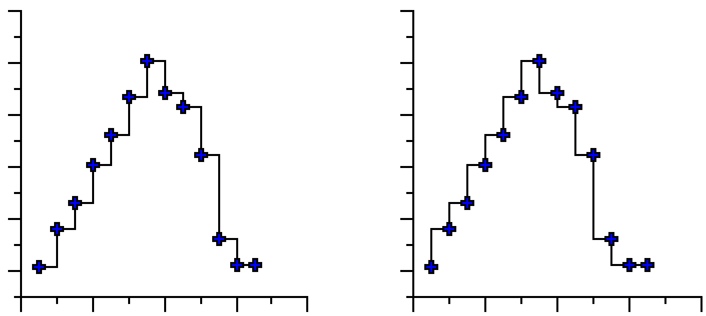
- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Step Lines

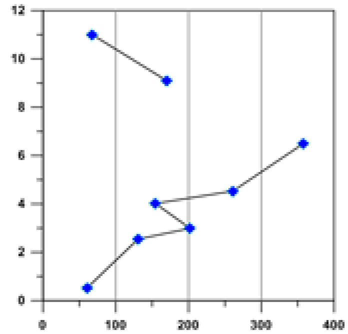
The *Step line initial direction* option determines how the step line is drawn between any two adjacent points. When *Horizontal* is selected the step lines are drawn so that they leave each data point parallel to the X axis. When *Vertical* is selected the step lines are drawn so that they leave each data point parallel to the Y axis. To change the *Step line initial direction*, click on the current option. Select the desired method of drawing the lines from the list. The plot automatically updates.



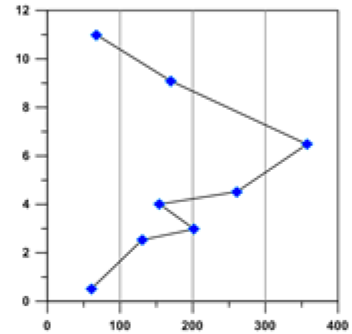
The plot on the left shows the step plot with the Step lines initial direction *set to* Horizontal*. The plot on the right is set to* Vertical*.*

Missing Data

Rows containing text or blanks in the plotted columns are ignored and are not plotted on the graph. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set. Data filtered using the *Criteria* settings are not included as missing data. *Missing data* is not available for all plot types.



This plot has the Missing data *option set to* Discontinuous plot*. The line breaks across the missing data point.*



This plot has the Missing data *option set to* Continuous *plot. The line continues and does not break across the missing data point.*

Change Axes

Click on the axis name next to the *X axis*, or *Y axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis* or *Y axis* lists.

3D Settings

The *3D Settings* section includes options for specifying the width, location, and number of lines in a 3D step plot.

Position

The *Position* option controls the location of the plot on the depth axis of the 3D plot. For example, 0 percent places the plot at the front of the graph, 100 percent places the plot at the back of the graph, and 50 percent places the plot in the middle of the graph. To change the position, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the position of the plot.

Width

The *Plot width* controls the width of the plot. Plots can be 0.01 to 6 inches (0.025 and 15.24 cm) wide. To change the width, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the width of the plot.

Line Frequency

Use the *Line frequency* field to control the cross lines along the plot width. The lines are usually drawn at each data point over the width of the plot, that is *Line frequency* is set to 1. When there are many points on the graph, the line color may overwrite most of the ribbon fill color. Use the *Linefrequency* option to skip lines on the plot. For example, if *Line frequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped between lines. To change the *Line frequency*, click the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the number of cross lines in the plot.

New Plot

Click the *Create* button next to the *New plot* command to create a new plot based on the current data file. A new plot is created using the same *X column* as the selected plot. The *Y column* changes to the next column in the worksheet that contains data. For example, if a selected step plot uses column A for the *X column* and column B for the *Y column*, clicking *Create* generates a new step plot with column A for the *X column* and column C for the *Y column*.

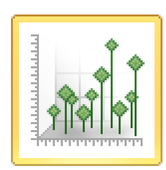
The new step plot is selected so you can change the new plot's properties. The line, fill, and/or symbol color automatically changes to a new color. The *Plot palette* option on the **Options** dialog Plots page controls the colors for plots added via the *Create* button in the **Plot** page.

Fit Curves

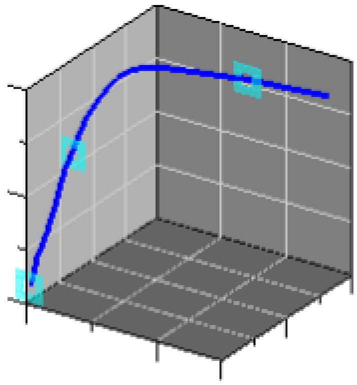
Click the **Home | Add to Graph | Fit Curve** command to add a fit curve to the graph. This adds a linear fit by default. Many fit types are available.

3D XYZ Plots

Click the **Home | New Graph | Basic | XYZ Line/Scatter Plot** command to display three variable data as a line, symbols, or as a combination of a line and symbols in 3D. The data are plotted in the order in which they appear in the data file.



Click the ***XYZ Line/Scatter Plot*** *button to* *create a 3D XYZ line/scatter plot.*



You can control the depth, line properties, and symbol properties in a 3D line/scatter plot.

Creating a New XYZ Line/Scatter Plot

To create a XYZ line/scatter plot:

1. Click the **Home | New Graph | Basic | XYZ Line/Scatter Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A 3D XYZ line/scatter plot is created using the default properties.

Editing XYZ Line/Scatter Plot Properties

To change the features of a XYZ line/scatter plot— including the data used to create the plot— first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

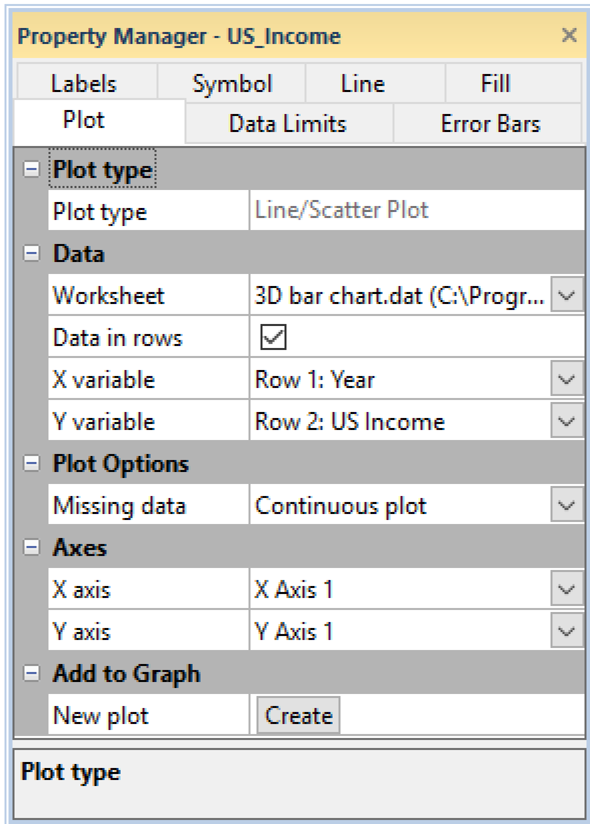
Labels

Symbol

Line

Plot Page - Line, Scatter, and Line/Scatter Plots

The line, scatter, and line/scatter plot properties **Plot** page contains the options to change the data file and axes; create fit curves in the plot; and add a new plot to the graph. To view and edit line/scatter plot properties, click on the line/scatter plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the line/scatter plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *Y column*, and *Z column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

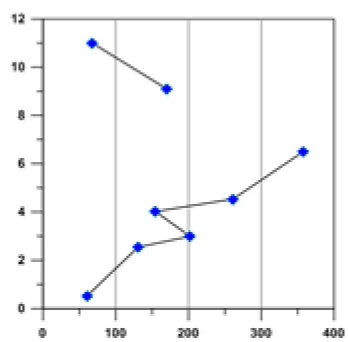
- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

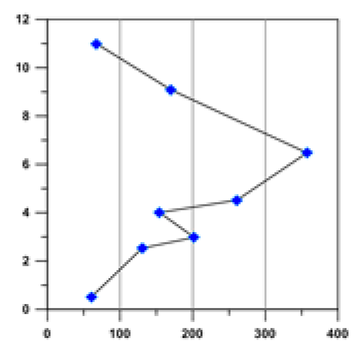
NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Missing Data

Rows containing text or blanks in the plotted columns are ignored and are not plotted on the graph. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set. Data filtered using the *Criteria* settings are not included as missing data. *Missing data* is not available for all plot types.



This plot has the Missing data *option set to* Discontinuous plot*. The line breaks across the missing data point.*



This plot has the Missing data *option set to* Continuous *plot. The line continues and does not break across the missing data point.*

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

3D Settings

The *3D Settings* section is displayed for an XYZ line/scatter plot and includes options for displaying drop lines and plot projections.

Drop Lines

3D XYZ plots have vertical, horizontal, and Z drop line options. When the box next to the *Vertical drop lines* option is checked, lines are drawn from the points to the bottom wall (XZ plane). When the box next to the *Horizontal drop lines* option is checked, lines are drawn from the point to the side wall (YZ plane). When the box next to the *Z drop lines* option is checked, lines are drawn from the point to the back wall (XY plane).

Drop Axis

When the *Vertical drop lines* or *Horizontal drop lines* box is checked, you can choose the plane to which the lines are drawn. Drop lines are drawn from the data point to the plane that intersects the drop axis minimum.

- For vertical drop lines, the XZ plane to which the drop lines are drawn is specified by the *Vert drop axis* minimum location.
- For horizontal drop lines, the YZ plane to which the drop lines are drawn is specified by the *Horz drop axis* minimum location.
- Z drop lines are always drawn to the XY plane at the Z axis maximum. There is no Z drop axis property.

Click on the current axis name next to *Vert drop axis* or *Horz drop axis*. In the list, select the desired axis. The plot is automatically updated to show the lines from the points to this axis minimum.

Drop Line Frequency

If there are many drop lines, you can change the frequency the lines are drawn by entering a new number into the *Line frequency* box. For example, if *Linefrequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped. To change the *Line frequency*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the number of drop lines in the plot.

Drop Line Properties

The drop line properties can be individually controlled with the *Vert drop line properties*, *Horz drop line properties*, and *Z drop line properties* sections on the Line page. Click the next to the appropriate section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the drop lines.

Projection Lines

Projection lines are also available for 3D XYZ plots. Projection lines are 2D representations of the 3D lines and appear on the various axis walls. Check the boxes next to the *Back projection*, *Side projection*, or *Bottom projection* options to add one, two, or all three of these projection lines to the graph. The *Back projection* option places the XY projection on the back wall of the graph. The *Side projection* option places the YZ projection on the side wall. The *Bottom* projection places the XZ projection on the bottom wall.

The projection line properties can be controlled in the *Projection line properties* section on the Line page. Click the ⊞ next to the *Projection line properties* section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the projection lines.

New Plot

Click the *Create* button next to the *New plot* command to create a new plot based on the current data file. A new plot is created using the same *X column* as the selected plot. The *Y column* changes to the next column in the worksheet that contains data. For example, if a selected line/scatter plot uses column A for the *X column* and column B for the *Y column*, clicking the *Create* button generates a new line/scatter plot with column A for the *X column* and column C for the *Y column*.

The new line/scatter plot is selected so you can change the new plot's properties. The line, fill, and/or symbol color automatically changes to a new color. The *Plot palette* option on the **Options** dialog Plots page controls the colors for plots added via the *Create* button in the **Plot** page.

Fit Curves

Click the **Home | Add to Graph | Fit Curve** command to add a fit curve to the graph. This adds a linear fit by default. Many fit types are available.

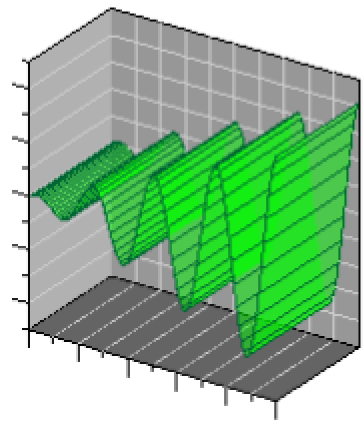
3D Function Plots

Click the **Home | New Graph | Basic | 3D Y=F(X) Function Plot**, **Home | New Graph | Basic | 3D X=F(Y) Function Plot**, or **Home | New Graph | Basic | 3D Parametric Function Plot** commands to display mathematical functions as a 3D plot. Data files are not required for this type of plot. You can plot Y as a

Click the **3D Y=F(X) Function Plot**, **3D X=F(Y) Function Plot**, *or* **3D Parametric Function Plot** *buttons to create 3D function plots.*

function of X, plot X as a function of Y, or plot a parametric equation where X and Y are functions of a third variable, T. The 3D XY Function Plot is commonly used to plot vertical lines, for example with X = F(Y) = 100.

Regardless of the command clicked to create the plot, any 3D function plot can be changed to another 3D function type in the **Property Manager**.



*This is an example of 3D YX function plot of the equation Y=F(X)=Cos(X)*X*

Creating a New 3D Function Graph

To create a 3D function graph:

1. Click the **Home | New Graph | Basic | 3D Y=F(X) Function Plot** command, the **Home | New Graph | Basic | 3D X=F(Y) Function Plot** command, or the **Home | New Graph | Basic | 3D Parametric Function Plot** command.
2. A 3D function plot is created using a default equation.

Editing 3D Function Plot Properties

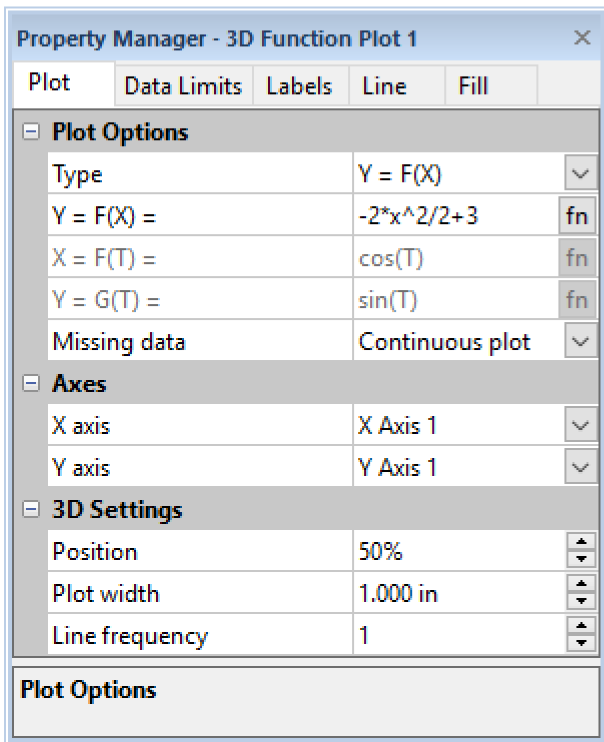
To change the features of a 3D function plot— including the equations used to create the plot— first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot
Data Limits
Labels
Line
Fill

Plot Page - Function Plots

To view and edit function plot properties, click on the function plot in the Object Manager or plot window to select it. Click the **Plot** tab in the Property Manager. You can change the axes and set equations and function intervals for the function plot or 3D function plot.



*Click on the **Plot** tab in the **Property Manager** to edit the plot properties for the function plot.*

Plot Type

The *Plot type* property displays the type of plot.

Type

The *Type* option determines if the plot is created with a set of equations or a single equation. When the *Type* field is set to *Y = F(X)*, functions are entered in the form Y as a function of X in the *Y = F(X)=* field. When the *Type* field is set to *X = F(Y)*, functions are entered in the form X as a function of Y in the *X = F(Y)=* field. If *Type* is set to *Parametric*, enter X and Y as functions of T in the *X = F(T)=* and *Y = G(T)=* fields.

Function

Enter the function equation in the *Y = F(X) =* or *X = F(Y) =* box. The form of the function updates automatically with the *Type* selection. To change the equation, highlight the existing equation. Type a new equation in the box. Press ENTER on the keyboard to make the change.

For parametric equations, enter the X portion of the equation in the *X=F (T) =* box. Enter the Y portion of the equation in the *Y=F(T) =* box. To change the equation, highlight the existing equation. Type a new equation in the box. Press ENTER on the keyboard to make the change.

In both cases, you can click the fn button to open the Functions dialog and add predefined mathematical functions to the equation or you can type the functions into the fields manually.

Missing Data

When the function and value limits settings results in an undefined value, e.g. 1/0 or ln(-1), the value is not plotted. These undefined points are treated as missing data. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

3D Settings

The *3D Settings* section includes options for specifying the width, location, and number of lines in a 3D function plot.

Position

The *Position* option controls the location of the plot on the depth axis of the 3D plot. For example, 0 percent places the plot at the front of the graph, 100 percent places the plot at the back of the graph, and 50 percent places the plot in the middle of the graph. To change the position, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the position of the plot.

Width

The *Plot width* controls the width of the plot. Plots can be 0.01 to 6 inches (0.025 and 15.24 cm) wide. To change the width, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the width of the plot.

Line Frequency

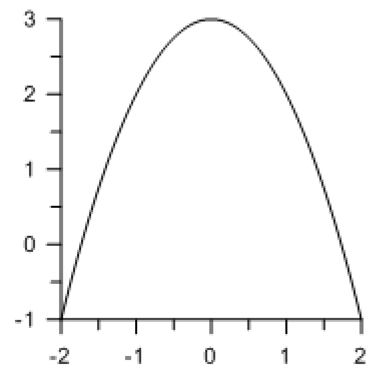
Use the *Line frequency* field to control the cross lines along the plot width. The lines are usually drawn at each data point over the width of the plot, that is *Line frequency* is set to 1. When there are many points on the graph, the line color may overwrite most of the ribbon fill color. Use the *Linefrequency* option to skip lines on the plot. For example, if *Line frequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped between lines. To change the *Line frequency*, click the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the number of cross lines in the plot.

Example 1

To create a plot using the equation:

Y= 3 - x2

1. Select a function plot.
2. Click the **Plot** tab in the Property Manager to access the *Plot Properties* page.
3. Set *Type* to *Y = F(X)*.
4. Highlight the contents of the *Y = F(X)=* box and then type 3 - x^2.
5. Move your cursor to the end of the equation and press ENTER on your keyboard. The equation is drawn on the graph.



This function plot is the result of the parametric equation listed in example 1.

Example 2

To create a plot using the equation:

X = 2t

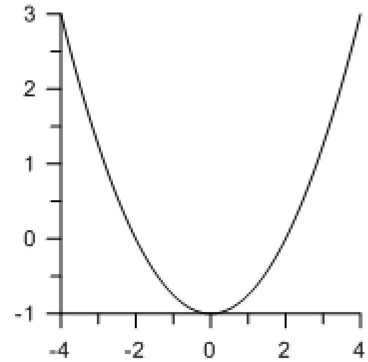
Y = t2 - 1

-2 ≤ 0 ≤ 2

1. Select a function plot.
2. Click the **Plot** tab in the Property Manager to access the *Plot Properties* page.
3. Set *Type* to *Parametric*.
4. Highlight the contents of the *X = F(T)=* field and enter 2*T.
5. Highlight the contents of the *Y = G(T)=* field and click the  button to the right of the equation box.
6. In the Functions dialog, select *POW(X,Y)* from the function list.
7. Click the *Insert* button in the **Functions** dialog.
8. Replace X,Y in POW(X,Y) with T,2.
9. After POW(T,2) type -1. Your equation in the Y=G(T)= field should appear like this:

   POW(T,2)-1

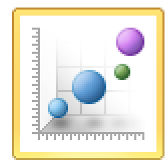
10. Enter -2 in the *First value* field.
11. Enter 2 in the *Last value* field.



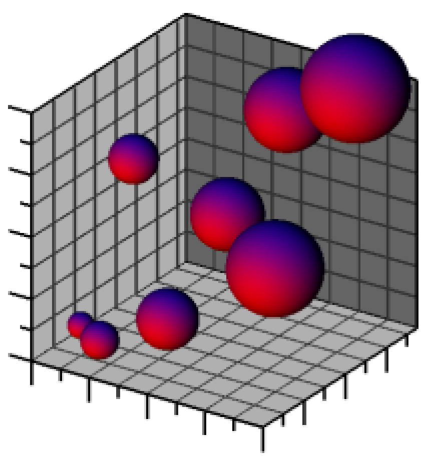
This function plot is the result of the parametric equation listed in example 2.

XYZ Bubble Plots

Click the **Home | New Graph | Basic | XYZ Bubble Plot** command to display four variables on a scatter-type plot. The diameter of each bubble can vary in size and Z position, providing a way to represent more data on a single plot.



*Click the **XYZ Bubble Plot** button to create an XYZ bubble plot.*



3D XYZ bubble plots show X, Y, Z, and size variables.

Creating a New XYZ Bubble Plot

To create an XYZ bubble plot:

1. Click the **Home | New Graph | Basic | XYZ Bubble Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. An XYZ bubble plot is created using the default properties.

Editing XYZ Bubble Plot Properties

To change the features of an XYZ bubble plot— including the columns used to create the plot— first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

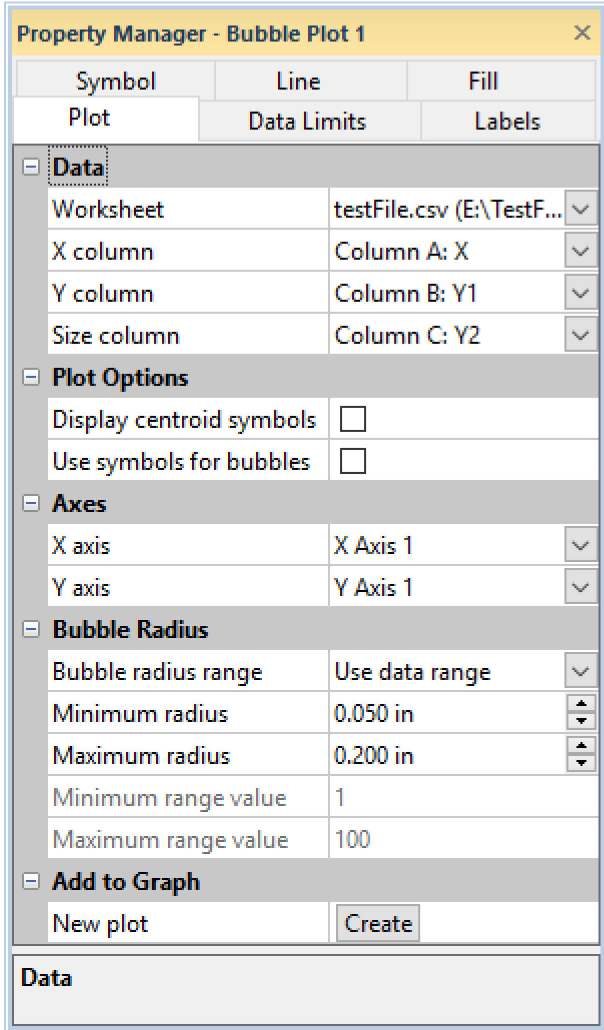
Labels

Line

Fill

Plot Page - Bubble Plots

The bubble plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; set bubble properties; and add a new plot to the graph. To view and edit bubble plot properties, click on the bubble plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



Change the bubble plot properties in the ***Property Manager*** *on the* ***Plot*** *tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the**Open Worksheet**dialog, and click the*Open*button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click

on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *Y column*, *Z column, Size column,* and *Color column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

With 2D bubble plots, the *Z column* is used as the bubble size. In 3D XYZ bubble plots, the *Z column* is a dimension and the *Size column* controls bubble size. In ternary bubble plots, the *Size column* controls the bubble size. The *Color column*determines the color of the 3D XYZ bubbles.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

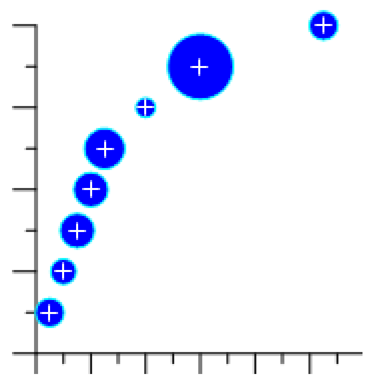
When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a

numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Bubble Centroids

The centroid location for each bubble can be displayed as a symbol on 2D bubble plots. This symbol is not scaled, and sometimes it is easier to distinguish overlapping bubbles when the centroid is visible. Check the box next to the *Display centroid symbols* to show the X, Y location of the data point as a symbol. Click the ⊞ next to *Centroid symbol* to set the centroid symbol properties.



Symbols can be displayed on the bubble's X, Y location.

Bubble Symbol

By default, the symbols in the bubble plot are open circles. The bubble line and fill color are set on the Line tab and Fill tab in the Property Manager.

Symbols other than scaled circles can be used for bubbles. To change the scaled symbol, check the box next to the *Use symbols for bubbles* option. You can change the symbol properties by clicking the ⊞ next to *Bubble symbol*.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

Fixed Value Based Bubble Radius Range

There are two ways to define the bubble radius range, using a fixed range or using a data range. Next to the *Bubble radius range*option, select *Use fixed range* to set the radius range based on user-defined data values. Use this method when you have multiple data sets in a similar range and would like to have the same data values represented by the same bubble size with each plot.

When the *Bubble radius range* is set to *Used fixed range*, enter a *Minimum data value* and *Maximum data value*. The *Minimum data value* is assigned to the *Minimum radius* size, the *Maximum data value* is assigned to the *Maximum radius* size. Each bubble's radius is then calculated by the bubble’s data value and where it falls between the minimum and maximum data values.

To change the *Minimum data value* or *Maximum data value*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. The *Minimum data value* and *Maximum data value* are in *Z column* units for a 2D bubble plot and *Size column*units for a 3D XYZ bubble plot.

To change the *Minimum radius* or *Maximum radius* values, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the size. The *Minimum radius*and*Maximum radius*values are in page units.

Data Based Bubble Radius Range

Set the *Bubble radius range* option to *Use data range* to automatically use the data's minimum and maximum values for determining bubble size. With this method, the smallest value in the *Z column* for 2D bubble plots or the *Size column* 3D XYZ bubble plots is displayed as the *Minimum radius* value. The largest value in the *Z column* for 2D bubble plots or the *Size column* for 3D XYZ bubble plots is displayed as the *Maximum radius* value. Intermediate values are displayed proportionally between these two values.

To change the *Minimum radius* or *Maximum radius* values, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the size. The *Minimum radius* and *Maximum radius* values are in page units.

Radius Formula

The formula used for bubble size by both methods is:

Br = ((Z - Zmin)/(Zmax - Zmin)) * (Rmax - Rmin) + Rmin

where:

Br	bubble radius
Z	bubble data value
Zmin	minimum data value with *Use data range*; *Minimum data value* with *Use fixed range*
Zmax	maximum data value with *Use data range*; *Maximum data value* with *Use fixed range*
Rmin	Minimum radius
Rmax	Maximum radius

When using the *Use data range* method, the *Minimum radius* is the smallest bubble ever drawn. Similarly, the *Maximum radius* is the largest bubble ever drawn. When using the *Use fixed range* method, the bubble radii may be smaller or larger than the *Minimum radius* or *Maximum radius* sizes should any bubble’s data value be either smaller or larger than the *Minimum data value* or *Maximum data value* entries.

3D Settings

The *3D Settings* section is displayed for an XYZ bubble plot and includes options for displaying drop lines and modifying 3D bubble appearance.

Drop Lines

3D XYZ plots have vertical, horizontal, and Z drop line options. When the box next to the *Vertical drop lines* option is checked, lines are drawn from the points to the bottom wall (XZ plane). When the box next to the *Horizontal drop lines* option is checked, lines are drawn from the point to the side wall (YZ plane). When the box next to the *Z drop lines* option is checked, lines are drawn from the point to the back wall (XY plane).

Drop Axis

When the *Vertical drop lines* or *Horizontal drop lines* box is checked, you can choose the plane to which the lines are drawn. Drop lines are drawn from the data point to the plane that intersects the drop axis minimum.

- For vertical drop lines, the XZ plane to which the drop lines are drawn is specified by the *Vert drop axis* minimum location.
- For horizontal drop lines, the YZ plane to which the drop lines are drawn is specified by the *Horz drop axis* minimum location.
- Z drop lines are always drawn to the XY plane at the Z axis maximum. There is no Z drop axis property.

Click on the current axis name next to *Vert drop axis* or *Horz drop axis*. In the list, select the desired axis. The plot is automatically updated to show the lines from the points to this axis minimum.

Drop Line Frequency

If there are many drop lines, you can change the frequency the lines are drawn by entering a new number into the *Line frequency* box. For example, if *Linefrequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped. To change the *Line frequency*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the number of drop lines in the plot.

Drop Line Properties

The drop line properties can be individually controlled with the *Vert drop line properties*, *Horz drop line properties*, and *Z drop line properties* sections on the Line page. Click the next to the appropriate section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the drop lines.

Draw Method and Color

There are three methods for drawing 3D bubbles. Next to the *Draw method* property, select *Wire frame 1*, *Wire frame 2*, or *Gradient fill*. To change the *Draw method*, select the current method and select the desired method from the list.

The wire frame methods draw lines on the bubbles. The line color and opacity is controlled on the Line page, and the background fill color and opacity is controlled on the Fill page. To change the *Line color* or *Fill color*, click on the existing color. In the list, select the new desired color. The *Line opacity* and *Fill opacity* control the amount of transparency for the wire frame lines and fill colors. To change the *Line opacity* or *Fill opacity*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the opacity.

The number of lines drawn on the bubbles is determined by the *Wireframe line count* property. You can draw between 10 and 100 lines on each bubble. The *Wireframe line count* field is only available when one of the wire frame methods is selected. To change the *Wireframe line count* , highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the line count.

When the *Draw method* is set to *Gradient fill*, the bubble is drawn with a color gradient across the bubble. Select or edit the color gradient *Colormap* on the Fill page. When using gradient fill, the *Gradient detail* option is also available. The *Gradient detail* determines how finely the gradient is drawn. You can set the *Gradient detail* between 10 and 1000. Lower numbers draw the gradient coarsely and higher numbers draw the gradient smoothly. The higher the value, the longer it takes to refresh the graph. To change the *Gradient detail*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the gradient detail.

Rotation

Use the *Bubble X rotation* and *Bubble Y rotation* settings to rotate the bubbles in the X and Y directions. Rotation values are in degrees. A positive rotation in the *Bubble X rotation* rotates the bottom of the bubble forward toward the screen. A positive rotation in the *Bubble Y rotation* rotates the front of the bubble clockwise.

Lighting Properties

The *Lighting* section includes the lighting properties: style, direction, color, and shininess.

New Plot

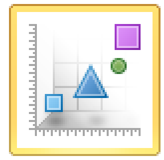
Click the *Create* button next to the *New plot* command to create a new plot based on the current data file. A new plot is created using the same *X column* and *Y column* as the selected plot. The *Size column* changes to the next column in the worksheet that contains data. For example, if a selected bubble plot uses column A for X values, column B for Y values, and column C for size values, clicking *Create* generates a new bubble plot with column A for X values, column B for Y values, and column D for size values.

The new bubble plot is selected so you can change the new plot's properties. The line, fill, and/or symbol color automatically changes to a new color for 2D bubble plots. The *Plot palette* option on the **Options** dialog

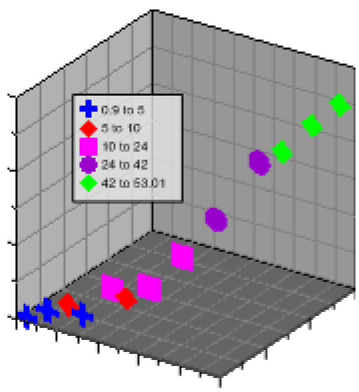
Plots page controls the colors for plots added via the *Create* button in the **Plot** page.

XYZ Class Scatter Plots

Click the **Home | New Graph | Basic | XYZ Class Scatter Plot** command to create a class scatter plot in three dimensions. An XYZ class scatter plot is a scatter plot with symbols that mark the intersection of X, Y, and Z column data based on a required fourth value (*Class* column). Class scatter plots group data into discrete classes (bins). The data points are displayed using the symbol assigned to the class. Class scatter plots include a legend by default.



Click the ***XYZ Class Scatter Plot*** *button to create an XYZ class plot.*



The location of each of the XYZ class plot's XYZ data points are based on the Class *value.*

Creating a New XYZ Class Scatter Plot

To create an XYZ class scatter plot:

1. Click the **Home | New Graph | Basic | XYZ Class Scatter Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. An XYZ class plot is created using the default properties.

Editing XYZ Class Scatter Plot Properties

To change the features of an XYZ class plot— including the column used to control the class— first select the class scatter plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

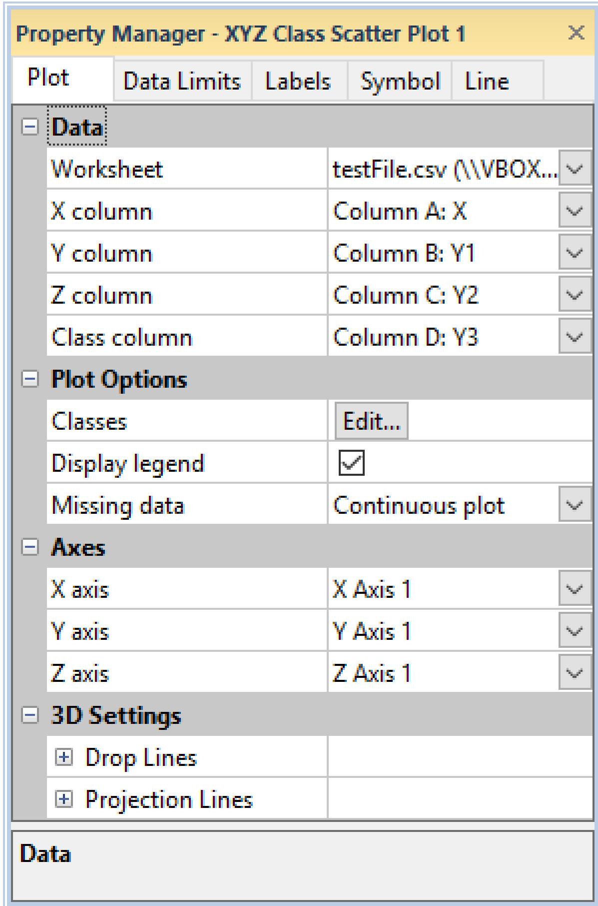
Labels

Symbol

Line

Plot Page - Class Scatter Plots

The class scatter plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; edit the classes used for the plot, and display the legend. To view and edit class scatter plot properties, click on the class scatter plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the class scatter plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column* and *Y column* or *Z column* (XYZ class scatter plot and Ternary class scatter plot only), *Radius column* (polar class scatter only), *Direction column* (polar class scatter only), and *Class column* fields. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

Note that the value in neither the *Row number* or *Sequence number* can be used in the *Class column*. The *Row number* and *Sequence number* cannot be used for any columns in a ternary class scatter plot.

When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Labels will automatically be unchecked to match the new data.

When the *Class column* includes only numeric values, a default number of classes is automatically created and all data points are displayed in one of the classes. When the *Class column* includes one or more text strings, the class*Method* is set to *Name* and the number of classes matches the number of unique text strings. Numbers are treated as text when the class method is set to *Name*.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Classes

Click the *Edit* button next to *Classes* to launch the Edit Classes dialog, which allows you to edit class information.

Display Legend

Check the box next to the *Display legend* option to make the class scatter plot legend visible. Clear the *Display legend* option to hide the legend. The legend display can also be changed in the **Object Manager** by checking or clearing the display box.

Class scatter plot legends cannot be copied and pasted. If you need to copy a class scatter plot legend, click on the legend to select it. Click the Detach Legend command to break the legend apart into multiple objects. The individual objects can be edited, but the link between the legend and the data is destroyed.

Missing Data

Rows containing text or blanks in the plotted columns are ignored and are not plotted on the graph. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set. Data filtered using the *Criteria* settings are not included as missing data. *Missing data* is not available for all plot types.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

Polar class scatter plot and ternary class scatter plot axes cannot be changed.

3D Settings

The *3D Settings* section is displayed for an XYZ class scatter plot and includes options for displaying drop lines and plot projections.

Drop Lines

3D XYZ plots have vertical, horizontal, and Z drop line options. When the box next to the *Vertical drop lines* option is checked, lines are drawn from the points to the bottom wall (XZ plane). When the box next to the *Horizontal drop lines* option is checked, lines are drawn from the point to the side wall (YZ plane). When the box next to the *Z drop lines* option is checked, lines are drawn from the point to the back wall (XY plane).

Drop Axis

When the *Vertical drop lines* or *Horizontal drop lines* box is checked, you can choose the plane to which the lines are drawn. Drop lines are drawn from the data point to the plane that intersects the drop axis minimum.

- For vertical drop lines, the XZ plane to which the drop lines are drawn is specified by the *Vert drop axis* minimum location.
- For horizontal drop lines, the YZ plane to which the drop lines are drawn is specified by the *Horz drop axis* minimum location.
- Z drop lines are always drawn to the XY plane at the Z axis maximum. There is no Z drop axis property.

Click on the current axis name next to *Vert drop axis* or *Horz drop axis*. In the list, select the desired axis. The plot is automatically updated to show the lines from the points to this axis minimum.

Drop Line Frequency

If there are many drop lines, you can change the frequency the lines are drawn by entering a new number into the *Line frequency* box. For example, if *Linefrequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped. To change the *Line frequency*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the number of drop lines in the plot.

Drop Line Properties

The drop line properties can be individually controlled with the *Vert drop line properties*, *Horz drop line properties*, and *Z drop line properties* sections on the Line page. Click the next to the appropriate section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the drop lines.

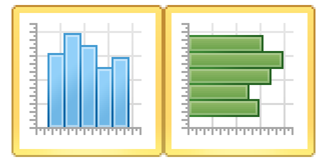
Projection Lines

Projection lines are also available for 3D XYZ plots. Projection lines are 2D representations of the 3D lines and appear on the various axis walls. Check the boxes next to the *Back projection*, *Side projection*, or *Bottom projection* options to add one, two, or all three of these projection lines to the graph. The *Back projection* option places the XY projection on the back wall of the graph. The *Side projection* option places the YZ projection on the side wall. The *Bottom* projection places the XZ projection on the bottom wall.

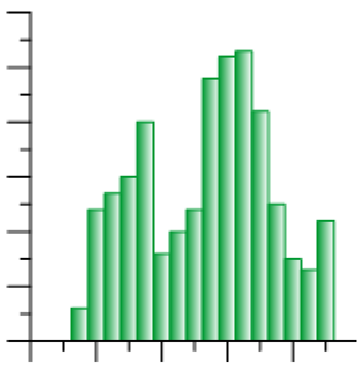
The projection line properties can be controlled in the *Projection line properties* section on the Line page. Click the next to the *Projection line properties* section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the projection lines.

Horizontal Bar Charts and Vertical Bar Charts

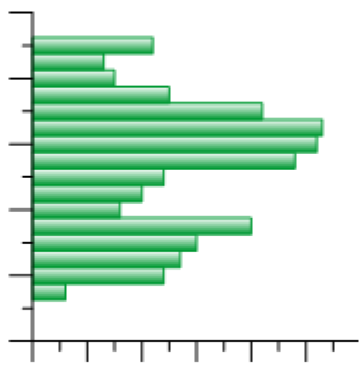
Click the **Home | New Graph | Bar | Horizontal Bar Chart** or **Home | New Graph | Bar | Vertical Bar Chart** command to display data as bars drawn from a base value to a data value. If more than one variable is used (multiple Y values for each X value), the bars can be stacked on top of one another or they can be adjacent to each other. When adjacent bars are used the values are plotted side by side. When stacked bars are used the total height of the stacked bars is equal to the sum of the data values. The bars can be oriented vertically or horizontally. The bar chart discussion assumes a vertical bar chart.



Click the **Horizontal Bar Chart** *or* **Vertical Bar Chart** *button to create a horizontal or vertical bar chart.*



Vertical bar charts show data values as bars from the base line to the data point.



Horizontal bar charts show data values as bars from the base line to the data point.

To create bars based on a frequency of values within a bin, use the histogram instead.

Creating a New Horizontal or Vertical Bar Chart

To create a bar chart:

1. Click the **Home | New Graph | Bar | Horizontal Bar Chart** or **Home | New Graph | Bar | Vertical Bar Chart** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.

3. Click the *Open* button. A bar chart is created using the default properties.

Editing Bar Chart Properties

To change the features of a bar chart— including the columns used to create the chart— first select the bar chart in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager**to change different properties:

Plot

Data Limits

Error Bars

Labels

Symbol

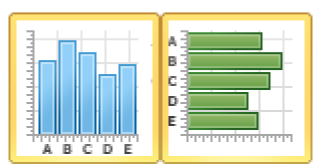
Line

Fill

Bar Groups

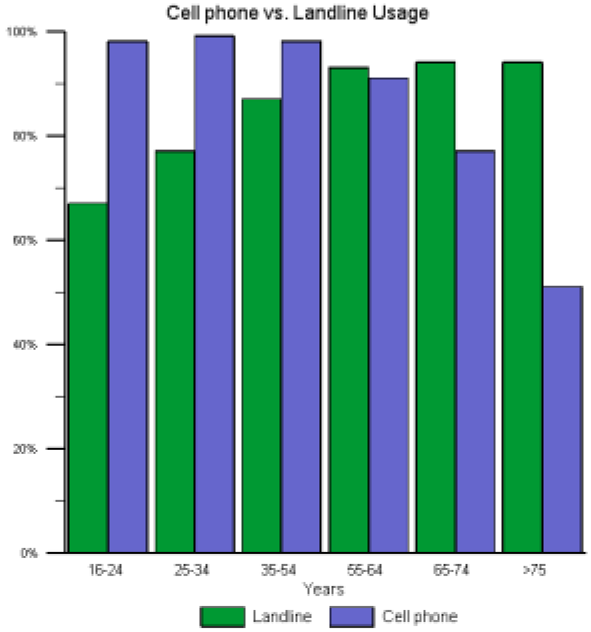
Horizontal Category Bar Charts and Vertical Category Bar Charts

Click the **Graphs | Create | Bar | Horizontal Category Bar Chart** or **Graphs | Create | Bar | Vertical Category Bar Chart** command to display data as bars drawn from a base value to a data value. If more than one variable is used (multiple Y values for each X value), the bars can be stacked on top of one another or they can be adjacent to each other. When adjacent bars are used the values are plotted side by side. When stacked bars are used the total height of the stacked bars is equal to the sum of the data values. The bars can be oriented vertically or horizontally. The bar chart discussion assumes a vertical bar chart.



Click the **Horizontal Category Bar Chart** *or* **Vertical Category Bar Chart** *button to create a horizontal or vertical bar chart from categories.*

Category bar charts use a text name for grouping categories.



Category bar charts show non-numeric categories as bars from the base line to the data val-

ue.

Creating a New Horizontal or Vertical Bar Chart

To create a bar chart:

1. Click the **Home | New Graph | Bar | Horizontal Category Bar Chart** or **Home | New Graph | Bar | Vertical Category Bar Chart** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A category bar chart is created using the default properties.

For vertical category bar charts, the *X column* uses *Sequence number*. For horizontal category bar charts, the *Y column* uses *Sequence number*. The bar chart displays category labels near the axis that uses the *Sequence number*.

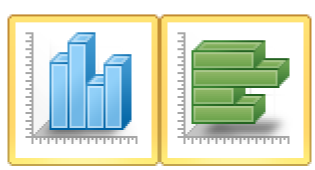
Editing Bar Chart Properties

To change the features of a bar chart— including the columns used to create the chart— first select the bar chart in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager**to change different properties:

Plot
Data Limits
Error Bars
Labels
Symbol
Line
Fill
Bar Groups

3D Bar Charts

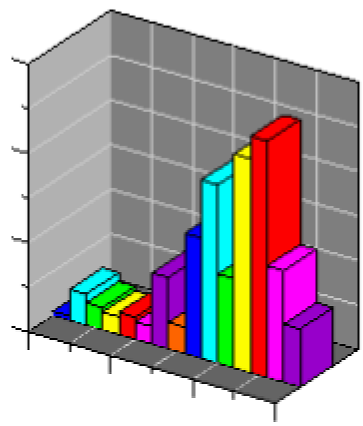


Click the **3D Vertical**

Click the **Graphs | Create | Bar | 3D Vertical Bar Chart** or the **Graphs | Create | Bar | 3D Horizontal Bar Chart** command to display data as 3D bars drawn from a base value to the Y data value. If more than one variable is used (multiple Y values for each X value), the bars can be stacked on top of one another or they can be adjacent to each other. When adjacent bars are used, the values are plotted side by side. When stacked bars are used the total height of the stacked bars is equal to the sum of the Y values.

Bar Chart *or* **3D Horizontal Bar Chart** *buttons to create 3D bar charts from 2 variables.*

The bars can be displayed vertically or horizontally. The bar chart discussion assumes a horizontal bar chart; reverse the X and Y for a vertical bar chart. To create bars based on a group of X values, use the histogram instead.



This is an example of a 3D bar chart.

Creating a New 3D Bar Chart

To create a 3D bar chart:

1. Click the **Home | New Graph | Bar | 3D Vertical Bar Chart** or the **Home | New Graph | Bar | 3D Horizontal Bar Chart** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A 3D bar chart is created using the default properties.

Editing 3D Bar Chart Properties

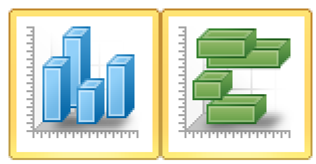
To change the features of a 3D bar chart— including the columns used to create the chart— first select the chart in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot
Data Limits
Error Bars
Labels
Symbol
Line
Fill
Bar Groups

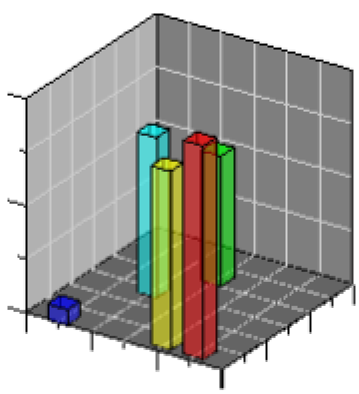
XYZ Bar Charts

Click the **Home | New Graph | Bar | XYZ Vertical Bar Chart** or **Home | New Graph | Bar | XYZ Horizontal Bar Chart** command to display data as bars drawn from a base value to the Y data value and positioned according to a Z value. If more than one variable is used (multiple Y values for each X, Z value), the bars can be stacked on top of one another or they can be adjacent to each other. When adjacent bars are used the values are plotted side by side. When stacked bars are used the total height of the stacked bars is equal to the sum of the Y values.



Click the **XYZ Vertical Bar Chart** *or* **XYZ Horizontal Bar Chart** *button to create a 3D horizontal or vertical bar chart from 3 variables.*

The bars can be displayed vertically or horizontally. The bar chart discussion assumes a horizontal bar chart; reverse the X and Y for a vertical bar chart.



3D XYZ bar charts show X, Y, and Z variables.

Creating a New XYZ Bar Chart

To create an XYZ bar chart:

1. Click the **Home | New Graph | Bar | XYZ Vertical Bar Chart** or **Home | New Graph | Bar | XYZ Horizontal Bar Chart** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. An XYZ bar chart is created using the default properties.

Editing 3D XYZ Bar Chart Properties

To change the features of an XYZ bar chart— including the columns used to create the chart— first select the chart in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

Labels

Line

Fill

Bar Groups

Bar Chart Multiple Variable Data Files

Multiple variable bar charts can be created from a single data file or from different data files. Typically the X values (for vertical bars) are the same for each of the bar charts. However the X values may be different between bar charts.

When creating stacked bar charts, each ***row*** of data is considered a stack. When creating adjacent bar charts, each ***row*** of data is plotted around the same X value. The same X value should not be repeated in multiple rows. If so, the bars will overwrite each other. Check for duplicate values in the X column by determining if there is a *Mode* with the Data Tools | Data | Statistics command.

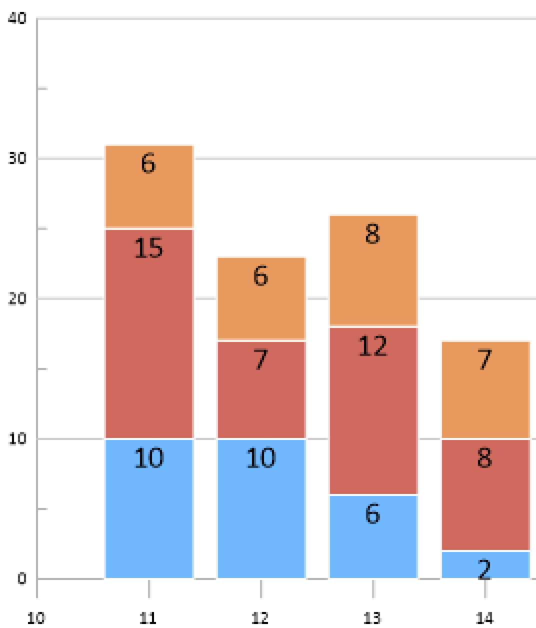
Multi-variate Bar Charts from One Data File

Here is an example of how a multi-variate bar chart data file should appear:

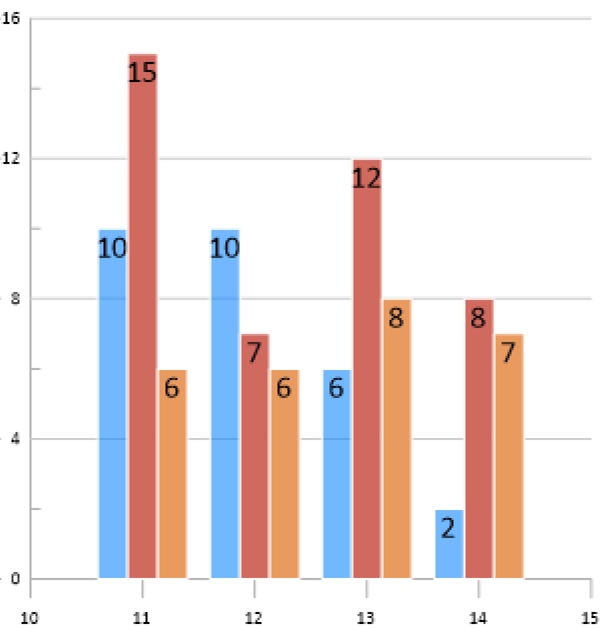
X	Bar 1	Bar 2	Bar 3	Total
11	10	15	6	31
12	10	7	6	23
13	6	12	8	26
14	2	8	7	17

There is one X column and three data columns. The *Total* column is optional and not plotted.

When creating a stacked bar chart, row 1 is plotted at X = 11 and Y reaches 31, row 2 is plotted at X = 12 and Y reaches 23, etc.



*Stacked bar charts plot bars on top of one another in the order specified in the **Object Manager**.*



*Adjacent bar charts group bars around their X values. The bar chart order is determined by the plot order in the **Object Manager**.*

The fastest method to create a graph with multiple plots is to use the Graph Wizard. However, to create the bar chart above from a single data file using the ribbon commands:

1. Click the **Graph | Create | Bar | Vertical Bar Chart** command.
2. Select your data file and click *Open*. The bar chart will be created

using the first two data columns, Column A: X and Column B: Bar 1 in this example.

3. Select *Bar Chart 1* in the Object Manager.
4. Click on the **Plot** tab. Scroll to the bottom and click the *Create*button next to the *New plot* command. This automatically creates Bar Chart 2, which uses Column C: Bar 2.
5. Click the *Create* button next to *New plot* for a second time. This will automatically creates Bar Chart 3, which uses the Column D: Bar 3.

It is easy to create multi-variate bar charts when the variables are all in a single data file.

Multi-variate Bar Charts from Multiple Data Files

The charts presented above can also be created from multiple data files. Notice the X values are repeated in each file.

X	Bar 1
11	10
12	10
13	6
14	2

Data file 1

X	Bar 2
11	15
12	7
13	12
14	8

Data file 2

X	Bar 3
11	6
12	6
13	8
14	7

Data file 3

When bar charts are created from different data files, bar charts must be grouped and the fill colors must be changed manually. Additionally the **Graph Wizard** cannot be used with multiple data files. Alternatively, use **Copy** and **Paste** or the **Data Tools | Edit | Import** command to combine data from multiple files into a single data file.

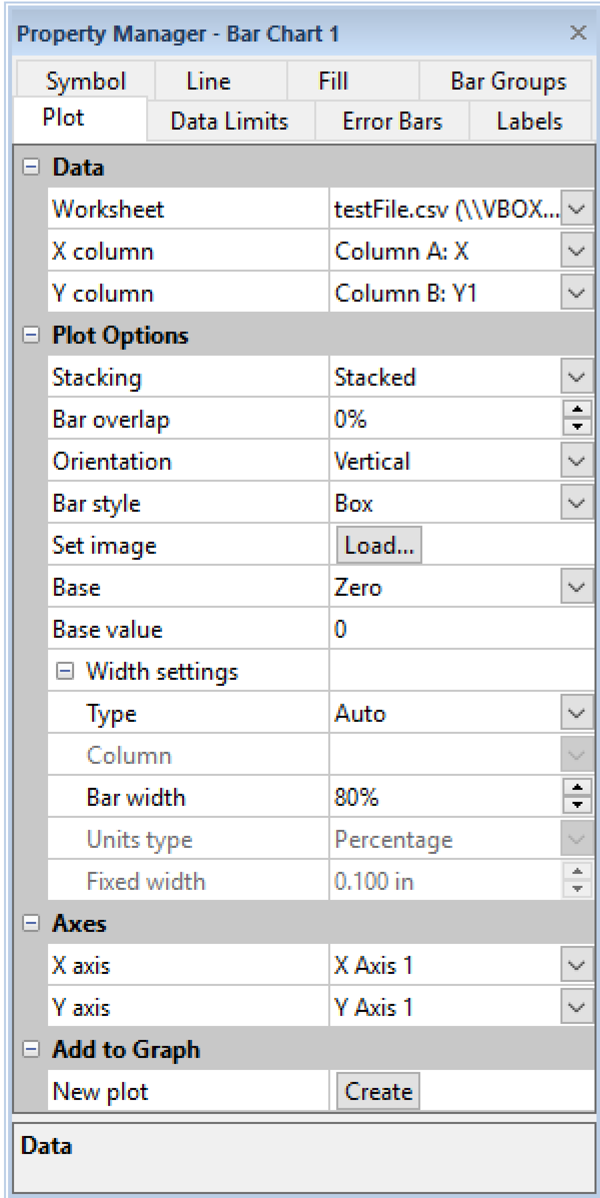
1. Click the **Home | New Graph | Bar | Vertical Bar Chart** command.
2. Select the first data file and click *Open*. A default bar chart is created.
3. Select *Bar Chart 1* in the **Object Manager**.
4. Click the Home | Add to Graph | Plot command.
5. Select *Bar Chart* in the **Select Plot Type** dialog and click *OK*.
6. Click *OK* in the **Choose Axes** dialog.
7. Select the second data file and click *Open*. A default bar chart is added to the graph. Notice the bar charts are overlapping, neither stacked nor adjacent.
8. Repeat steps 4 through 6.

9. Select the third data file and click *Open*. Another default bar chart is added to the graph.
10. Select *Bar Chart 1* in the **Object Manager**.
11. Click the **Bar Groups** tab in the **Property Manager**.
12. Click *Add* to add *Group 1*.
13. Select the check boxes next to each bar chart in the *Group 1* section. Now that all bar charts are in *Group 1*, the bars appear stacked correctly.
14. Change the fill color for *Bar Chart 2* and *Bar Chart 3* by selected each plot and changing the properties on the Fill tab. Change the plot to adjacent bars by selecting all three bar charts and changing the *Stacking* property on the Plot tab.

Plots from different data files can be combined in a single graph by taking the extra steps illustrated above.

Plot Page - Bar Charts

The bar chart plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; add a new plot to the graph; and set bar chart properties. To view and edit bar chart plot properties, click on the bar chart plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*The bar chart properties are edited in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open.

Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *Y column*, and *Z column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

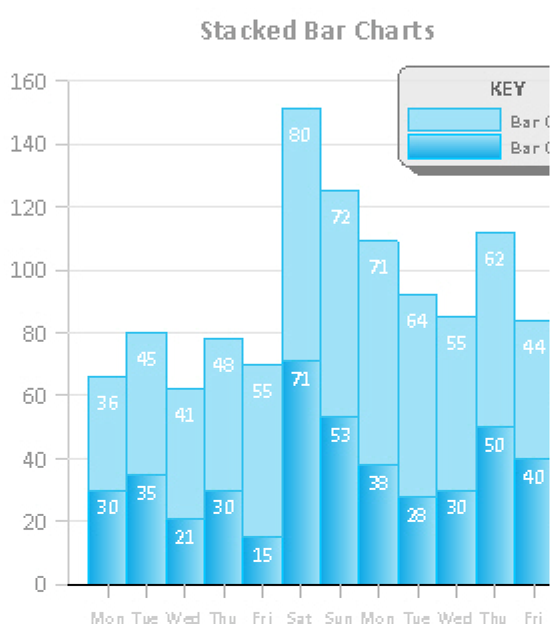
When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a

numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

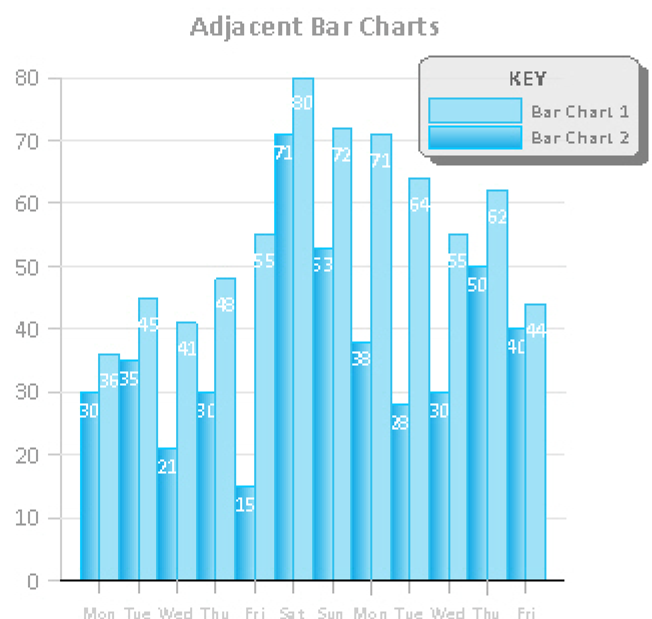
NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Plotting Multiple Variables

If multiple variables are plotted, the bars can be stacked or adjacent. Change the *Stacking* option to either *Stacked* or *Adjacent*. This setting affects all bar charts in a single bar chart group when multiple bar charts are plotted on one graph. To change the *Stacking*option, click on the existing option. In the list, select the new option.



These bars are stacked. The second bar is placed starting at the top of the first bar.

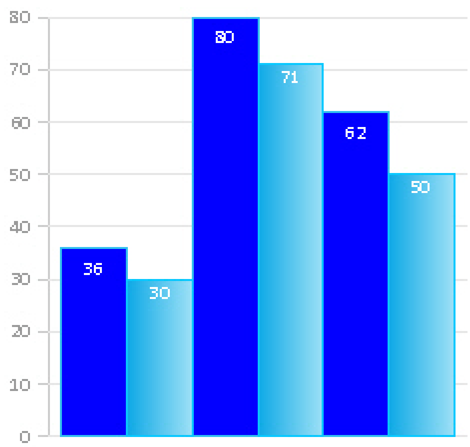


These bars are adjacent. The bars are located side by side.

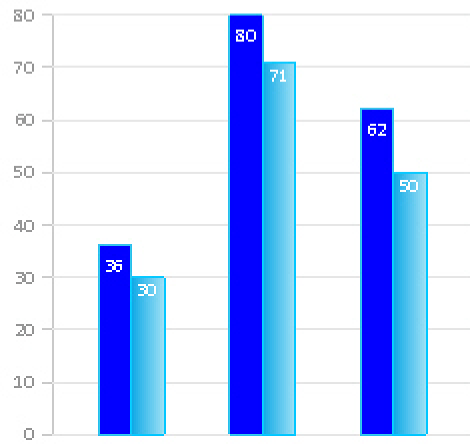
Adjacent

The *Adjacent* option draws variables as a group of bars. The group of bars for each X value are centered on the X value data value.

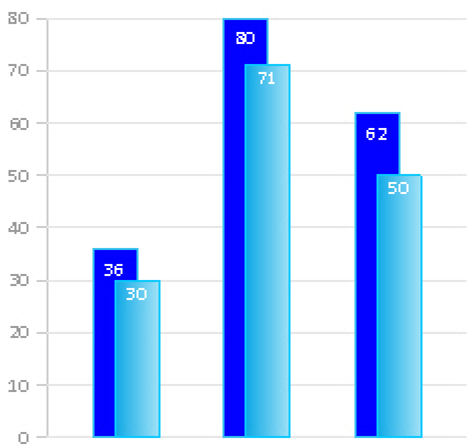
You can set the amount of overlap of the adjacent bars by typing a new number into the *Baroverlap* box. An overlap of zero means the bars in the same X value are touching. An overlap of greater than 0 means that the bars are overlapping. Using negative numbers in the *Baroverlap* field creates gaps between the bars within an X value. To change the *Bar overlap* value, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the amount of overlap.



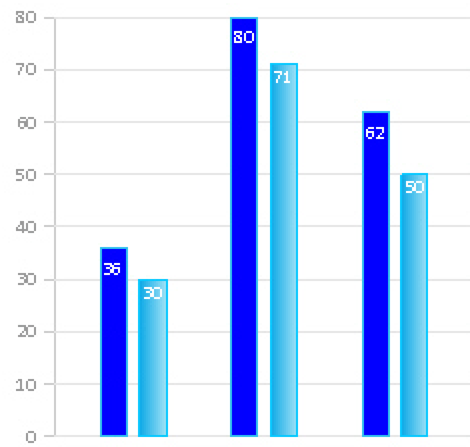
This adjacent bar chart shows 100 percent Bar width and 0 percent Bar overlap.



This adjacent bar chart shows 50 percent Bar width and 0 percent Bar overlap.



This adjacent bar chart shows 50 percent Bar width and 50 percent Bar overlap.

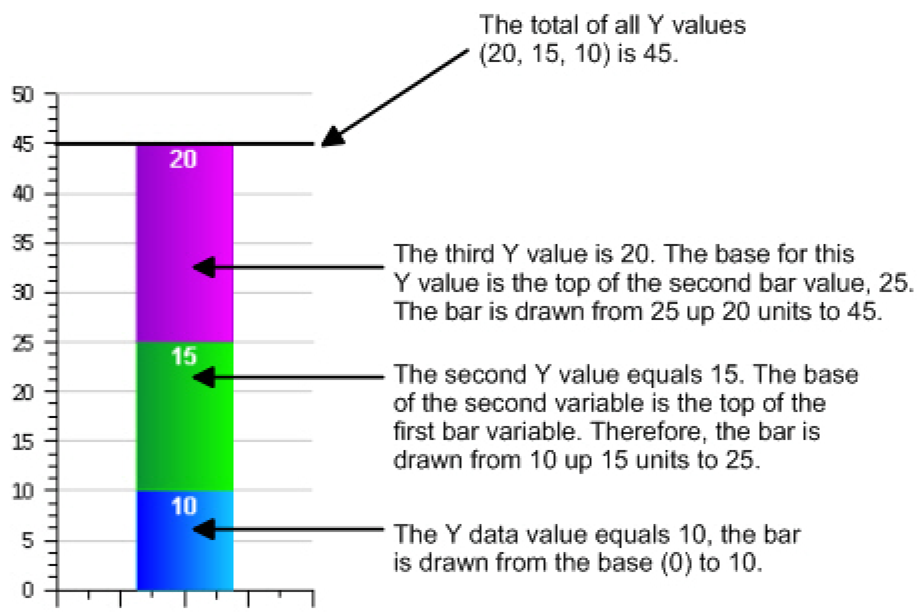


This adjacent bar chart shows 50 percent Bar width and -50 percent Bar overlap.

Stacked

The *Stacked* option draws all the variables one on top of the other. The base for additional variables are the ends of the previous variables. The total height of a stacked bar is the sum of all variables (Y values) for each X value.

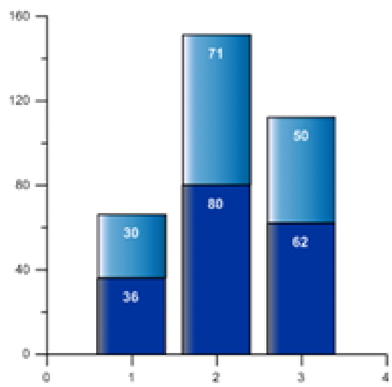
For example, there are three variables for X with the values 10, 15, and 20. The base of the stacked bar is set to zero. The first bar would be drawn from zero to 10. The next bar would be drawn from 10 to 25, and the final bar would be drawn from 25 to 45.



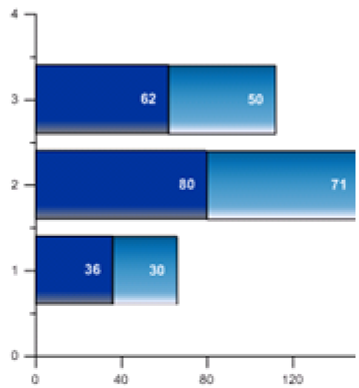
This example demonstrates how stacked bar heights are calculated.

Orientation

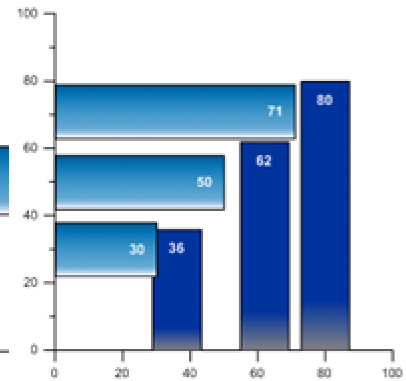
Bar charts and floating bar charts can be displayed horizontally or vertically. The *Orientation* options let you change the orientation of the bars. The default setting is *Vertical*, which plots the height of the bars vertically. The *Horizontal* option rotates the bars by 90°, showing the height of the bars horizontally. This results in a bar graph where the bars protrude horizontally from the vertical axis. This setting affects all bar charts in a bar chart group when multiple bar charts are plotted on one graph.



This bar chart is displayed vertically. Vertical is the default display.



This bar chart is displayed horizontally.



These bar charts are in different bar chart groups. One group is horizontal and one is vertical.

Bar Style

The *Bar style* option allows the bars to be drawn as rectangles or as another shape. To change the *Bar style*, click on the existing option. In the list, select a new option. The options available are *Box, Cone, Inverted cone, Diamond, Spindle,* and *Image*. The bar chart automatically updates to the new style.

If the *Bar style* is set to *Image*, the *Set image* command is used to load an image to display for the bars. Click the *Load* button next to *Set image* to open the Set Image dialog. Select the image and click *OK*to display the image on the bar chart.

Slices

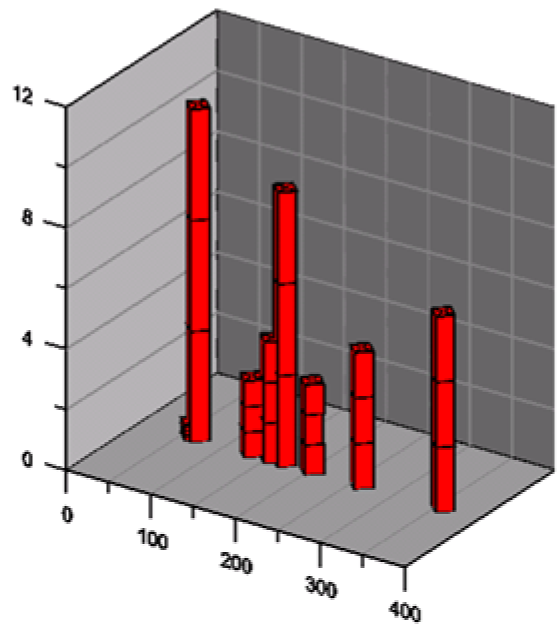
In a 3D XYY or 3D XYZ bar chart, when the *Bar style* is set to an option other than *Box*, the *Slices* option becomes available. The *Slices* option controls the number of sides that the 3D shape has. With a *Bar style* set to *Cylinder*, the more *Slices* the object contains, the closer to a round cylinder the object will be displayed. The *Slices* option can be set to a whole number between 2 and 100. When the *Slices* is set to 2, the object appears as two dimensional.

The line properties for the slice lines are set on the Line tab.

Stacks

In a 3D or 3D XYZ bar chart, when the *Bar style* is set to an option other than *Box*, the *Stacks* option becomes available. The *Stacks* option controls the number horizontally stacked sections that the 3D shape has. The *Stacks* option can be set to a whole number between 2 and 100.

The line properties for the stack lines are set on the Line tab.



This bar chart shows three horizontal stacks for each bar and four slices, making the cylinder diamond shaped.

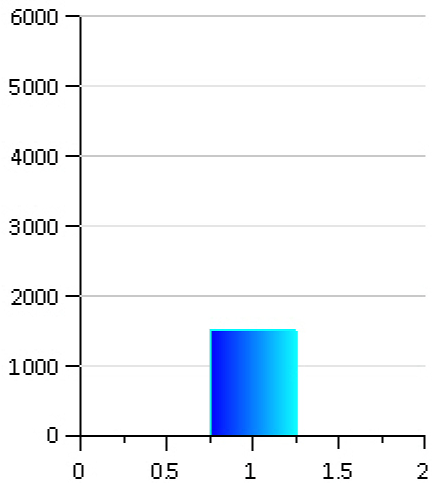
Bar Base

The *Base* and *Base value* indicate the location on the plot where the bars originate. The graph varies depending on the selected *Base value*. The *Base* of the bars can be set to the data minimum, to the data maximum, to zero, or to a custom value. The bars are drawn from the base value to the data point value. This setting affects all bar charts when multiple bar charts are plotted on one graph in the same bar chart group. To change the *Base* value, click on the existing option next to the *Base.* Select a new option from the list. Setting the *Base* to *Zero* causes all bars to originate at the zero axis value. Positive data values are drawn upward and negative data values are drawn downward. The *Data minimum* option draws all bars from the data minimum to the data value. The *Data maximum* option draws all bars from the data maximum to the data value.

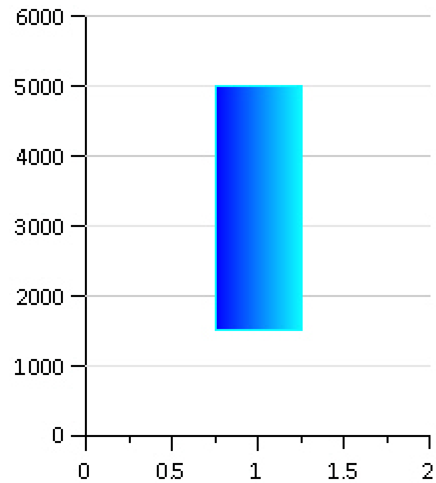
The *Custom* option draws all bars from the *Base value* to the data value. The bars are drawn upward or downward depending on the data values and the custom base number.

To set the *Base value*, highlight the existing value and type a new value into the box. Press ENTER on the keyboard to make the change.

For example, if the *Base* is set to *Zero* and the Y data value is 1500, the bar is drawn from zero to 1500 on the Y axis. If the *Base* is set to *Custom* and the *Base value* is set to 5000, the bar is drawn from 5000 to 1500.



The Y value is 1500 and the base is set to 0. The bar is drawn up to 1500.



The Y value is 1500 and the base is set to 5000. The bar is drawn down to 1500.

Width Settings

The *Width settings* section allows you to set the width of the bars and the method used to determine the width.

Type

The *Type* option determines how the bar width is determined.

- When *Type* is set to *Auto*, the percentage for the *Bar width* option determines the width of the bars.
- When *Type* is set to *Variable*, the *Variable units* and *[Type] variable* options become available to use worksheet columns to individually specify bar widths.
- When *Type* is set to *Fixed*, the *Fixed width* option becomes available.

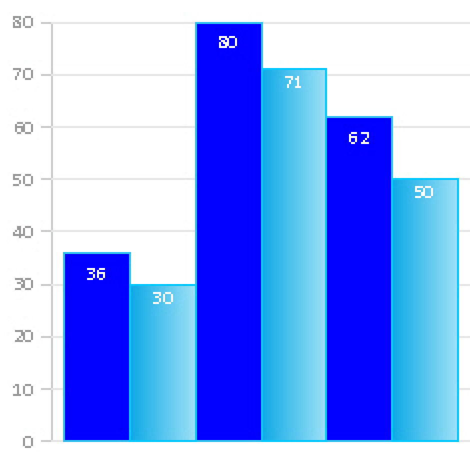
The *[Type] variable* option lets you select a worksheet column for the *Variable* type bar widths. The *[Type] variable* contains the width values for each bar individually. To change the *[Type] variable*, click on the existing value and select the new column from the list. The value in the *[Type] variable* can be in a *Percentage* units, *Page units*, *Width*, or *X2*.

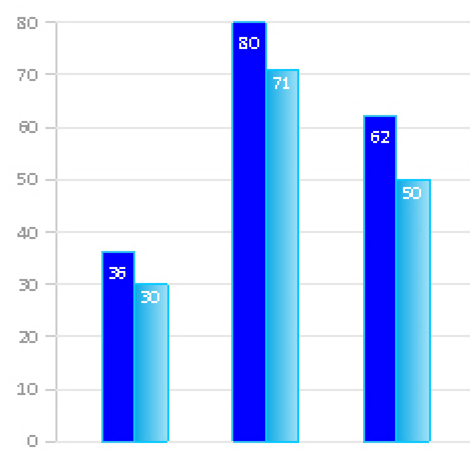
- *Percentage* values should be whole numbers specifying the percentage width. For example, the value 1 in the worksheet column is 1% width.
- *Page units* values should be specified in inches or centimeters.
- *Width* values set the width of the bar in X axis units.
- *X2* values specify the ending X axis value for the bar. The *X variable* in the *Data* section specifies the starting X value for the bar.

The *Fixed width* option allows you to simultaneously change the width of all bars in the graph to a fixed width, e.g., 0.25 inches. To change the *Fixed width*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the width of the bars. Enter a value between 0.001 and 50.00 inches (0.003 and 127 cm).

Bar Width

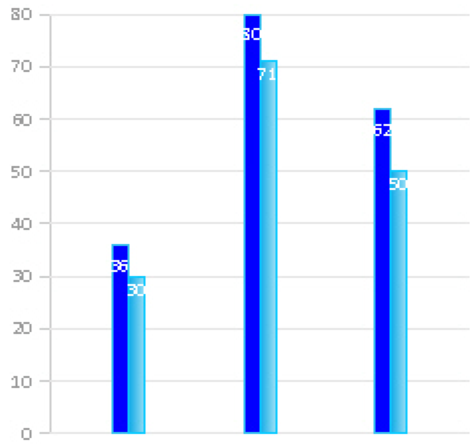
The *Bar width* field controls all of the bars in the graph in the same bar chart group. Set the width of the bars from 1 to 50000 percent. The default width is 80 percent. The 100 percent width is determined by the range of the X values. When the *Barwidth* is set to 100 percent, the bars touch and cover 100 percent of the data range. When the *Bar width* is set to 50 percent, the bars cover 50 percent of the data range and there are gaps between the bars. When the width is set to a value greater than 100 percent the bars overlap. This setting affects all bar charts when multiple bar charts are plotted on one graph. To change the value, either highlight the existing value and type a new value or click the to scroll to a new number. Press ENTER on the keyboard to update the plot.



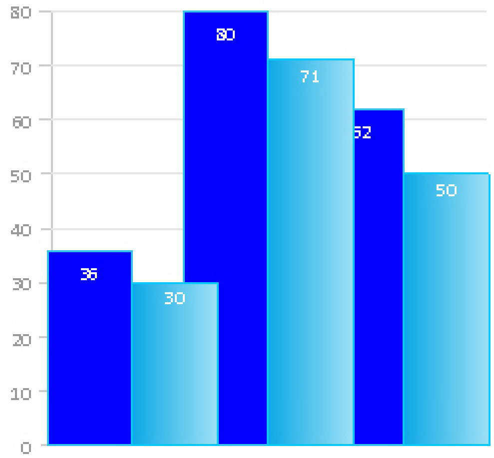


This graphs shows a Bar width of 100%. This is the default setting.

This graphs shows aBar widthof 50%.



This graphs shows aBar widthof 25%.



This graphs shows a Bar width of 125%.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

3D Settings

The *3D Settings* section of the **Plot** page includes the position and width settings for 3D bar charts.

Position

The *Position* option controls the location of the plot on the depth axis of the 3D plot. For example, 0 percent places the middle of the plot at the front of the graph, 100 percent places the middle of the plot at the back of the graph, and 50 percent places the plot in the middle of the graph. To change the value, either highlight the existing value and type a new value or click the to scroll to a new row number. Press ENTER on the keyboard to update the plot.

Plot Width

The *Plot width* controls how wide the plot is displayed. Plots can be 0.01 to 6 inches (0.025 and 15.24 cm) wide. To change the value, either highlight the existing value and type a new value or click the to scroll to a new row number. Press ENTER on the keyboard to update the plot.

New Plot

Click the *Create* button next to the *New plot* command to create a new bar chart based on the current data file. A new chart is created using the same *X column* as the selected chart and the next column for the *Y column*. For example, if a selected bar chart uses column A for X values and column B for Y values, clicking *Create* generates a new bar chart with column A for X values and column C for Y values. The new chart is selected so you can change the new chart's properties.

The new bar chart is automatically added to the same bar chart group as the first bar chart. The line, fill, and/or symbol color automatically changes to a new color. The *Plot palette* option on the **Options** dialog Plots page controls the colors for plots added via the *Create* button in the **Plot** page.

Bar Chart Groups

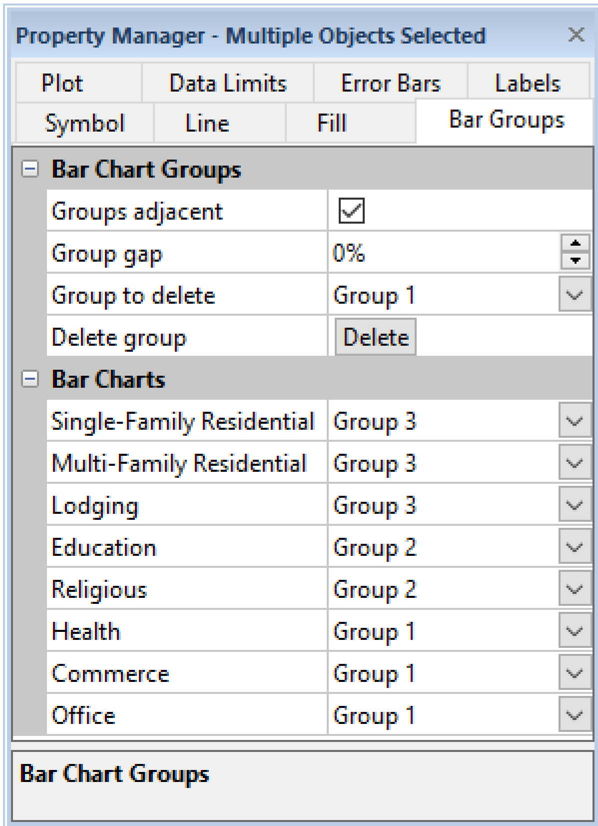
The **Bar Groups** page in the Property Manager is used to create bar chart groups. The bars within a group can be stacked or adjacent. The bar chart groups are drawn adjacent or overlapping. Ungrouped bar charts are always drawn overlapping grouped bars. Grouping various bar charts and changing the bar chart order in the **Object Manager** can provide interesting intra- and intergroup comparisons.

Drawing Order

Groups are drawn in order by group number. Group 1 is drawn first, Group 2 is drawn next, etc. Groups are plotted from left to right in vertical bar charts and from bottom to top in horizontal bar charts when the groups are plotted adjacent. The groups are drawn in order from back to front when groups are not plotted adjacent, i.e. the last group to be drawn will be visible when groups overlap.

Within groups, the draw order is determined by the bar chart order in the Object Manager. Bar charts that are lower in the **Object Manager** (earlier in the draw order) are plotted at the bottom of stacks, towards the left of adjacent vertical bars, or towards the bottom of adjacent horizontal bars. Conversely, bar charts that are higher in the **Object Manager** (later in the draw order) are plotted at the top of stacks, towards the right of adjacent vertical bars, or towards the top of adjacent horizontal bars.

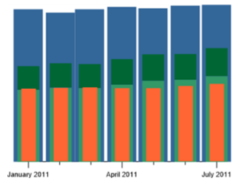
Experiment with both the bar chart order in the **Object Manager** and the group number for the bar charts to determine the best presentation for your grouped bar charts.



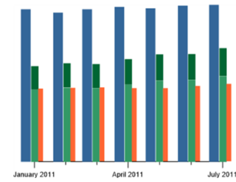
*The **Bar Chart** tab in the **Property Manager** defines the bar groups.*

Groups Adjacent

The *Groups adjacent* property specifies whether groups are plotted adjacent to other groups or overlaid with other groups at the same location. Check the *Groups adjacent* box to plot to groups adjacent to one another. When the *Groups adjacent* box is not checked, the groups will overlap. Groups cannot be plotted adjacent to one another with the Polar Bar Chart.



This example includes four bar charts in three groups. The two green bars are grouped and stacked. When Groups adjacent *is not checked the bars are drawn overlapping.*



This example shows the same bar charts with Groups adjacent selected*. The entire bar is visible in every month.*

Group Gap

The *Group gap* property specifies the space between groups when groups are adjacent, i.e. *Groups adjacent* is checked. Set the gap between bars from 0 to 5000 percent. The default setting is no gap between the groups. The gap size percentage is determined by the range of the X values. To change the value, either highlight the existing value and type a new value or click the  to scroll to a new number. Press ENTER on the keyboard to update the plot.

Delete Group

The *Group to delete* optionand the *Delete group* command are used to remove a group. First, select the group you wish to remove in the *Group to delete* field. Next click *Delete* to remove the bar chart group. Any bar charts in the deleted group will become ungrouped.

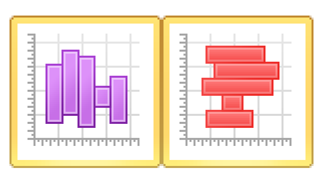
Bar Chart List

The *Bar Charts* section of the **Bar Groups** page includes all the bar charts in the graph and the group(s) to which the bar charts belong.

To move a bar chart into a different group, click the current group for a bar chart and select the desired group from the list. To make a bar chart ungrouped, select *None* from the list. Select *New Group* to add a new bar chart group to the list.

Floating Bar Charts

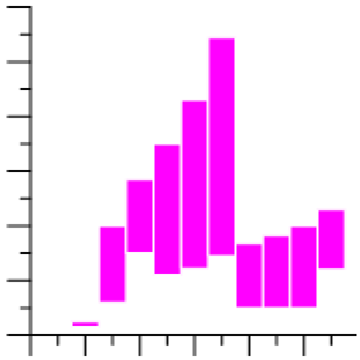
Click the **Home | New Graph | Bar | Horizontal Floating Bar Chart** or **Home | New Graph | Bar | Vertical Floating Bar Chart** command to show the difference between two sets of Y values. For each X value, the length of each floating bar is drawn from the min-



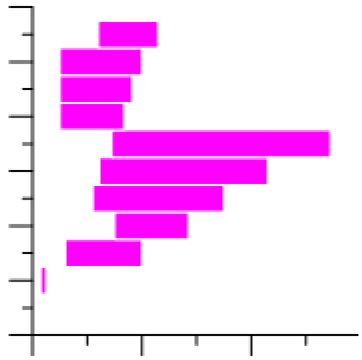
Click the **Vertical Float-**

imum Y value and rises to the maximum Y value. Floating bar charts can be oriented vertically or horizontally. The floating bar chart discussion assumes a vertical floating bar chart.

***ing Bar Chart** or **Horizontal Floating Bar Chart** buttons to create floating bar charts.*



Vertical floating bar charts show the difference between two Y values per one X value.



Horizontal floating bar charts show the difference between two X values per one Y value.

Creating a New Floating Bar Chart

To create a floating bar chart:

1. Click the **Home | New Graph | Bar | Horizontal Floating Bar Chart** or **Home | New Graph | Bar | Vertical Floating Bar Chart** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A floating bar chart is created using the default properties.

Editing Floating Bar Chart Properties

To change the features of a floating bar chart— including the columns used to create the chart— first select the floating bar chart in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

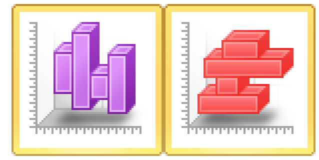
Data Limits

Labels

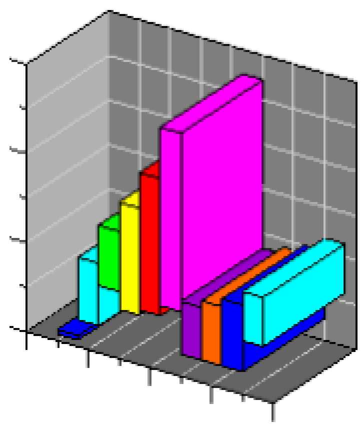
Line
Fill

3D Floating Bar Charts

Click the **Graphs | Create | Bar | 3D Vertical Floating Bar Chart** or **Graphs | Create | Bar | 3D Horizontal Floating Bar Chart** command to show the difference between two sets of Y values. For each X value, the length of each 3D floating bar is drawn from the minimum Y value and extends to the maximum Y value. Floating bar charts can be displayed either vertically or horizontally.



Click the **3D Vertical Floating Bar Chart** *or* **3D Horizontal Floating Bar Chart** *buttons to create 3D floating bar charts from 2 variables.*



This is an example of a 3D floating bar chart.

Creating a New 3D Floating Bar Chart

To create a 3D floating bar chart:

1. Click the **Home | New Graph | Bar | 3D Vertical Floating Bar Chart** or **Home | New Graph | Bar | 3D Horizontal Floating Bar Chart** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A 3D floating bar chart is created using the default properties.

Editing 3D Floating Bar Chart Properties

To change the features of a 3D floating bar chart— including the columns used to create the chart— first select the chart in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

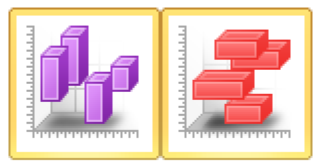
Labels

Line

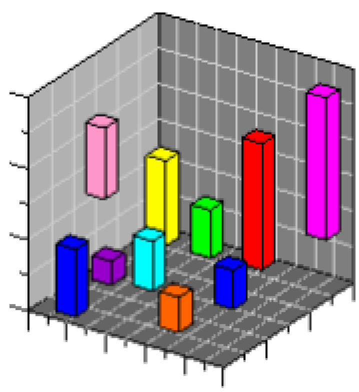
Fill

XYZ Floating Bar Charts

Click the **Graphs | Create | Bar | XYZ Vertical Floating Bar Chart** or **Graphs | Create | Bar | XYZ Horizontal Floating Bar Chart** command to show the difference between two variables with respect to a third variable. Floating bar charts can be displayed either vertically or horizontally.



*Click the **XYZ Vertical Floating Bar Chart** or **XYZ Horizontal Floating Bar Chart** button to create a 3D horizontal or vertical floating bar chart from 3 variables.*



This is an example of a 3D XYZ floating bar chart.

Creating a New XYZ Floating Bar Chart

To create an XYZ floating bar chart:

1. Click the **Home | New Graph | Bar | XYZ Vertical Floating Bar Chart** or **Home | New Graph | Bar | XYZ Horizontal Floating Bar Chart** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. An XYZ floating bar chart is created using the default properties.

Editing XYZ Floating Bar Chart Properties

To change the features of a XYZ floating bar chart— including the columns used to create the chart— first select the chart in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

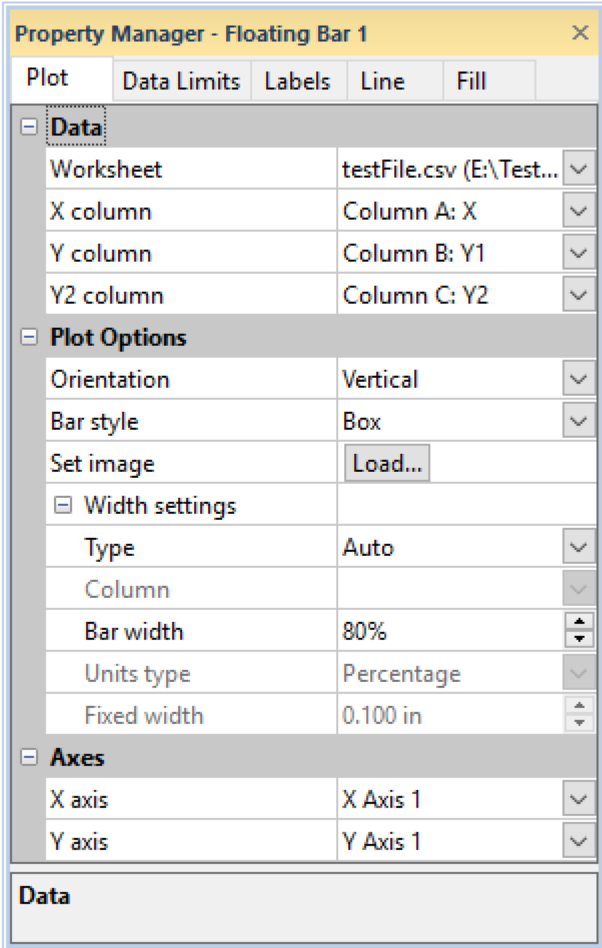
Labels

Line

Fill

Plot Page - Floating Bar Charts

To view and edit floating bar chart properties, select the floating bar chart and then click the **Plot** tab in the Property Manager. You can then change the data file and set data used in the floating bar chart, 3D floating bar chart, and 3D XYZ floating bar chart.



*The floating bar chart properties are edited in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the**Open Worksheet**dialog, and click the*Open*button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *X1column, X2 column,Y column*, *Y1 column*, *Y2 column*, and *Z column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

For *Vertical* floating bar charts, the data columns are *X column*, *Y1 column*, *Y2 column*, and *Z column*. The *Y1 column* and *Y2 column* indicate the lower and upper edges of the floating bars. For example, let's say you would like to show the change in population in cities from 1990 to 2000. The city would be the X axis value (the row number or sequence number would likely be used), *Y1 column* would show the 1990 population, and *Y2 column* would show the 2000 population. The bars are drawn between the two Y values. Cities with greater population changes would show as longer bars.

For *Horizontal* floating bar charts, the data columns are *Y column, X1column, X2 column,* and *Z column*. The *X1 column* and *X2 column* indicate the left and right edges of the floating bars.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

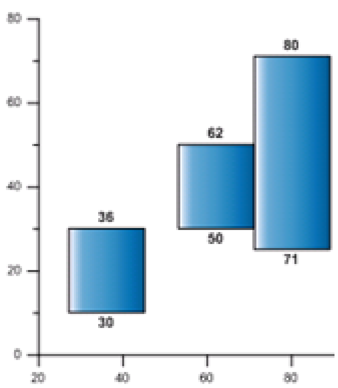
- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis [Tick Labels]() will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis [Tick Labels]() will automatically be unchecked to match the new data.

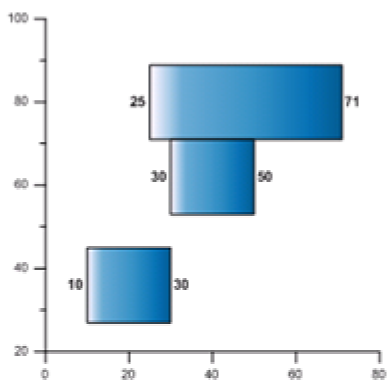
NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Orientation

Floating bar charts can be displayed horizontally or vertically. The *Orientation* options let you change the orientation of the bars. The default setting is *Vertical*, which plots the height of the bars vertically. The *Horizontal* option rotates the bars by 90°, showing the height of the bars horizontally. This results in a bar graph where the bars protrude horizontally from the vertical axis. This setting affects all floating bar charts in the graph.



This floating bar chart is displayed vertically. Vertical is the default display.



This floating bar chart is displayed horizontally.

Bar Style

The *Bar style* option allows the bars to be drawn as rectangles or as another shape. To change the *Bar style*, click on the existing option. In the list, select a new option. The options available are *Box, Cone,* *Inverted cone, Diamond, Spindle,* and *Image*. The floating bar chart automatically updates to the new style.

If the *Bar style* is set to *Image*, the *Set image* command is used to load an image to display for the bars. Click the *Load* button next to *Set image* to open the Set Image dialog. Select the image and click *OK* to display the image on floating the bar chart.

Slices

In a 3D or 3D XYZ bar chart, when the *Bar style* is set to an option other than *Box*, the *Slices* option becomes available. The *Slices* option controls the number of sides that the 3D shape has. With a *Bar style* set to *Cylinder*, the more *Slices* the object contains, the closer to a round cylinder the object will be displayed. The *Slices* option can be set to a whole number between 2 and 100. When the *Slices* is set to 2, the object appears as two dimensional.

The line properties for the slice lines are set on the Line tab.

Stacks

In a 3D or 3D XYZ bar chart, when the *Bar style* is set to an option other than *Box*, the *Stacks* option becomes available. The *Stacks* option controls the number horizontally stacked sections that the 3D shape has. The *Stacks* option can be set to a whole number between 2 and 100.

The line properties for the stack lines are set on the Line tab.

Width Settings

The *Width settings* section allows you to set the width of the bars and the method used to determine the width.

The *Type* option determines how the bar width is determined.

- When *Type* is set to *Auto*, the percentage for the *Bar width* option determines the width of the bars.
- When *Type* is set to *Column*, the *Column* and *Units type* options become available.
- When *Type* is set to *Fixed*, the *Fixed width* option becomes available.

The *Column* option lets you select a worksheet column. The *Column* contains the width values for each bar individually. To change the *Column*, click on the existing value and select the new column from the list. The value in the *Column* can be in a percentage or page units. Percentage values should be whole numbers. For example, the value 1 in the worksheet column is 1%.

The *Units type* option determines the *Column* data format. To change the *Units type* click on the existing value and select a new option from the list. If the data in the column is in percentages, select *Percentage*. If the column contains the width in either inches or centimeters, select *Page units*. The values in the width column should be in the same units as the application page units setting. The bar widths will change when the *Page units* setting is changed in the **Options** dialog Ruler and Grid page or with the **Layout | Display | Units** command. The bar widths are still scaled with the *Bar width* property when the *Type* is set to *Column*.

The *Fixed width* option allows you to simultaneously change the width of all bars in the graph to a fixed width, e.g., 0.25 inches. To change the *Fixed width*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the width of the bars. Enter a value between 0.001 and 50.00 inches (0.003 and 127 cm).

Bar Width

The *Bar width* field controls all of the bars in the graph in the same bar chart group. Set the width of the bars from 1 to 50000 percent. The default width is 80 percent. The 100 percent width is determined by the range of the X values. When the *Barwidth* is set to 100 percent, the bars touch and cover 100 percent of the data range. When the *Bar width* is set to 50 percent, the bars cover 50 percent of the data range and there are gaps between the bars. When the width is set to a value greater than 100 percent the bars overlap. This setting affects all bar charts when multiple bar charts are plotted on one graph. To change the value, either highlight the existing value and type a new value or click the to scroll to a new number. Press ENTER on the keyboard to update the plot.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

3D Settings

The *3D Settings* section of the **Plot** page includes the position and width settings for 3D floating bar charts.

Position

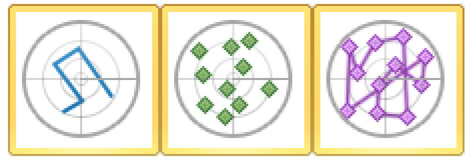
The *Position* option controls the location of the plot on the depth axis of the 3D plot. For example, 0 percent places the middle of the plot at the front of the graph, 100 percent places the middle of the plot at the back of the graph, and 50 percent places the plot in the middle of the graph. To change the value, either highlight the existing value and type a new value or click the to scroll to a new row number. Press ENTER on the keyboard to update the plot.

Plot Width

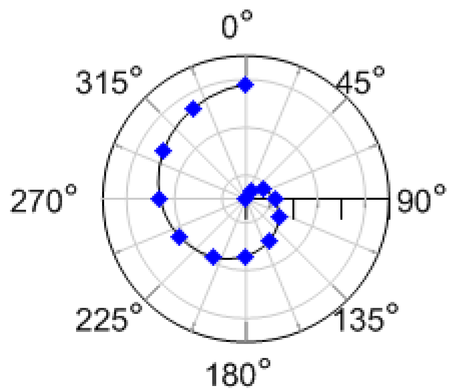
The *Plot width* controls how wide the plot is displayed. Plots can be 0.01 to 6 inches (0.025 and 15.24 cm) wide. To change the value, either highlight the existing value and type a new value or click the to scroll to a new row number. Press ENTER on the keyboard to update the plot.

Polar Line Plot, Polar Scatter Plot, Polar Line/Scatter Plot

Click the **Home | New Graph | Polar | Polar Line Plot**, **Home | New Graph | Polar | Polar Scatter Plot**, or **Home | New Graph | Polar | Polar Line/Scatter Plot** command to display degree, radian, or grad data versus a radial distance. Data can be displayed as symbols, lines, or lines and symbols.



Click the **Polar Line Plot**, **Polar Scatter Plot**, *or* **Polar Line/Scatter Plot** *command to create polar line, scatter, or line/scatter plots.*



Polar plots can have degree, radian, or grad units. This polar plot has labels to show degrees.

Creating a New Polar Graph

To create a polar graph:

1. Click the **Home | New Graph | Polar | Polar Line Plot**, **Home | New Graph | Polar | Polar Scatter Plot**, or **Home | New Graph | Polar | Polar Line/Scatter Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A polar line, scatter, or line/scatter plot is created using the default properties.

Editing Polar Plot Properties

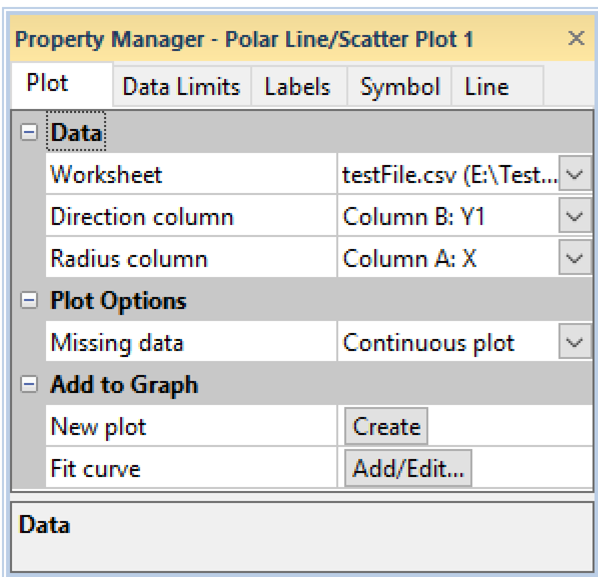
To change the features of a polar plot, including the columns used to create the graph, first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

[Plot]
[Data Limits]
[Labels]
[Symbol]
[Line]

Plot Page - Polar Plots

The polar plot properties **Plot** page contains the options to change the data file and set columns; create fit curves in the plot; and add a new plot to the graph. To view and edit line/scatter plot properties, click on the line/scatter plot in the plot window or [Object Manager] to select it. Then, click on the **Plot** tab in the [Property Manager].



*Change the polar plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *Direction column* and *Radius column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

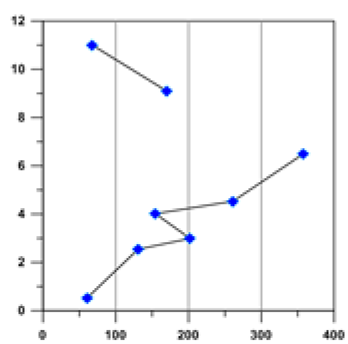
- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

When changing the *Direction column* or *Radius column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the columns to a numeric column from a date/-time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

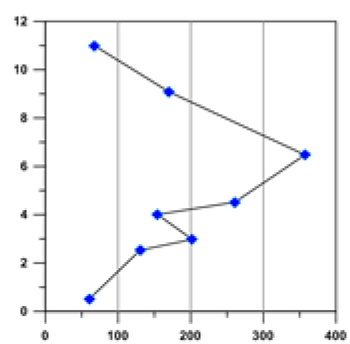
NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Missing Data

Rows containing text or blanks in the plotted columns are ignored and are not plotted on the graph. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set. Data filtered using the *Criteria* settings are not included as missing data. *Missing data* is not available for all plot types.



This plot has the Missing data *option set to* Discontinuous plot*. The line breaks across the missing data point.*



This plot has the Missing data *option set to* Continuous *plot. The line continues and does not break across the missing data point.*

New Plot

Click the *Create* button next to the *New plot* command to create a new plot based on the current data file. A new plot is created using the same *Radius column* as the selected plot. The *Angle column* changes to the next column in the worksheet that contains data. For example, if a selected line/scatter plot uses column A for the *Radius column* and column B for the *Angle column*, clicking *Create* generates a new line/scatter plot with column A for the *Radius column* and column C for the *Angle column*.

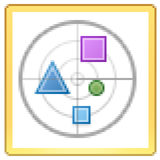
The new polar plot is selected so you can change the new plot's properties. The line, fill, and/or symbol color automatically changes to a new color. The *Plot palette* option on the **Options** dialog Plots page controls the colors for plots added via the *Create* button in the **Plot** page.

Fit Curves

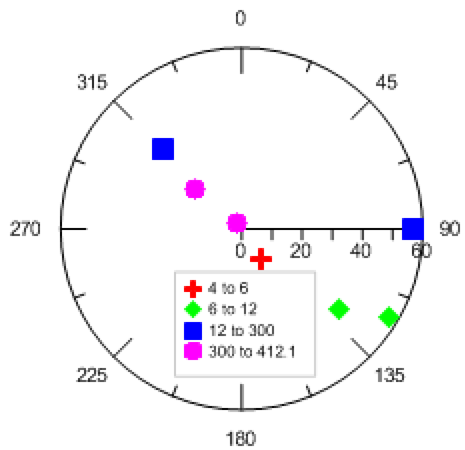
Click the **Home | Add to Graph | Fit Curve** command to add a fit curve to the graph. This adds a linear fit by default. Many fit types are available.

Polar Class Scatter Plot

Click the **Home | New Graph | Polar | Polar Class Scatter Plot** command to create a polar class scatter plot. A polar class scatter plot is a scatter plot with symbols that mark the intersection of X (*Radius Axis*) and Y (*Angle Axis*) coordinates based on a required third value (*Class* column). Class scatter plots group data into discrete classes (bins). The data points are displayed using the symbol assigned to the class. Class scatter plots include a legend by default.



Click the **Polar Class Scatter Plot** *button to create a polar class plot.*



The location of each of the 2D class scatter plot's XY data points is based on the Class value.

Creating a New Polar Class Scatter Plot

To create a polar class scatter plot:

1. Click the **Home | New Graph | Polar | Polar Class Scatter Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A polar class plot is created using the default properties.

Editing Polar Class Scatter Plot Properties

To change the features of a polar class scatter plot, including the column used to control the class, first select the polar class scatter plot in the plot window or Object Managerand then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

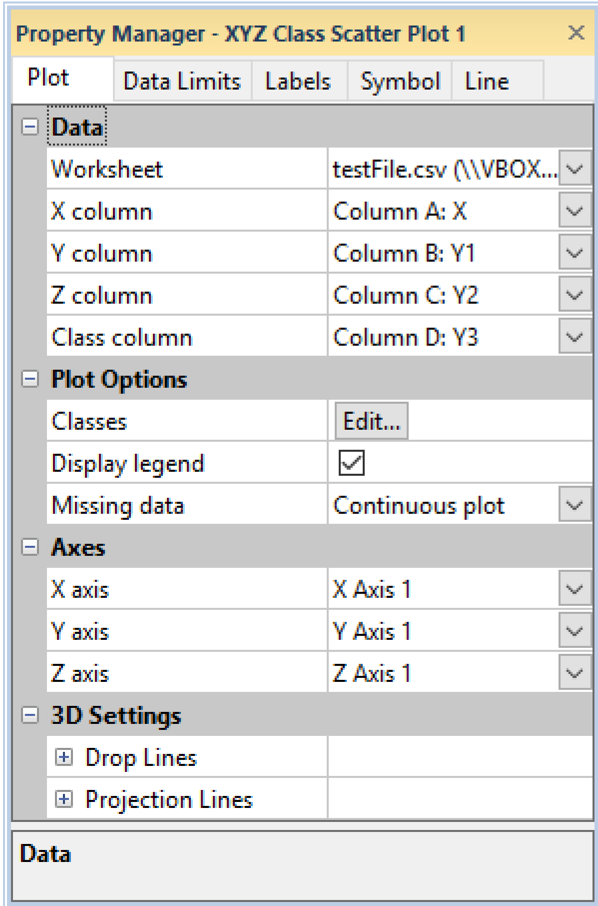
Labels

Symbol

Line

Plot Page - Class Scatter Plots

The class scatter plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; edit the classes used for the plot, and display the legend. To view and edit class scatter plot properties, click on the class scatter plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the class scatter plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column* and *Y column* or *Z column* (XYZ class scatter plot and Ternary class scatter plot only), *Radius column* (polar class scatter only), *Direction column* (polar class scatter only), and *Class column* fields. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

Note that the value in neither the *Row number* or *Sequence number* can be used in the *Class column*. The *Row number* and *Sequence number* cannot be used for any columns in a ternary class scatter plot.

When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Labels will automatically be unchecked to match the new data.

When the *Class column* includes only numeric values, a default number of classes is automatically created and all data points are displayed in one of the classes. When the *Class column* includes one or more text strings, the class*Method* is set to *Name* and the number of classes matches the number of unique text strings. Numbers are treated as text when the class method is set to *Name*.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Classes

Click the *Edit* button next to *Classes* to launch the Edit Classes dialog, which allows you to edit class information.

Display Legend

Check the box next to the *Display legend* option to make the class scatter plot legend visible. Clear the *Display legend* option to hide the legend. The legend display can also be changed in the **Object Manager** by checking or clearing the display box.

Class scatter plot legends cannot be copied and pasted. If you need to copy a class scatter plot legend, click on the legend to select it. Click the Detach Legend command to break the legend apart into multiple objects. The individual objects can be edited, but the link between the legend and the data is destroyed.

Missing Data

Rows containing text or blanks in the plotted columns are ignored and are not plotted on the graph. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set. Data filtered using the *Criteria* settings are not included as missing data. *Missing data* is not available for all plot types.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

Polar class scatter plot and ternary class scatter plot axes cannot be changed.

3D Settings

The *3D Settings* section is displayed for an XYZ class scatter plot and includes options for displaying drop lines and plot projections.

Drop Lines

3D XYZ plots have vertical, horizontal, and Z drop line options. When the box next to the *Vertical drop lines* option is checked, lines are drawn from the points to the bottom wall (XZ plane). When the box next to the *Horizontal drop lines* option is checked, lines are drawn from the point to the side wall (YZ plane). When the box next to the *Z drop lines* option is checked, lines are drawn from the point to the back wall (XY plane).

Drop Axis

When the *Vertical drop lines* or *Horizontal drop lines* box is checked, you can choose the plane to which the lines are drawn. Drop lines are drawn from the data point to the plane that intersects the drop axis minimum.

- For vertical drop lines, the XZ plane to which the drop lines are drawn is specified by the *Vert drop axis* minimum location.
- For horizontal drop lines, the YZ plane to which the drop lines are drawn is specified by the *Horz drop axis* minimum location.
- Z drop lines are always drawn to the XY plane at the Z axis maximum. There is no Z drop axis property.

Click on the current axis name next to *Vert drop axis* or *Horz drop axis*. In the list, select the desired axis. The plot is automatically updated to show the lines from the points to this axis minimum.

Drop Line Frequency

If there are many drop lines, you can change the frequency the lines are drawn by entering a new number into the *Line frequency* box. For example, if *Linefrequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped. To change the *Line frequency*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the number of drop lines in the plot.

Drop Line Properties

The drop line properties can be individually controlled with the *Vert drop line properties*, *Horz drop line properties*, and *Z drop line properties* sections on the Line page. Click the ⊞ next to the appropriate section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the drop lines.

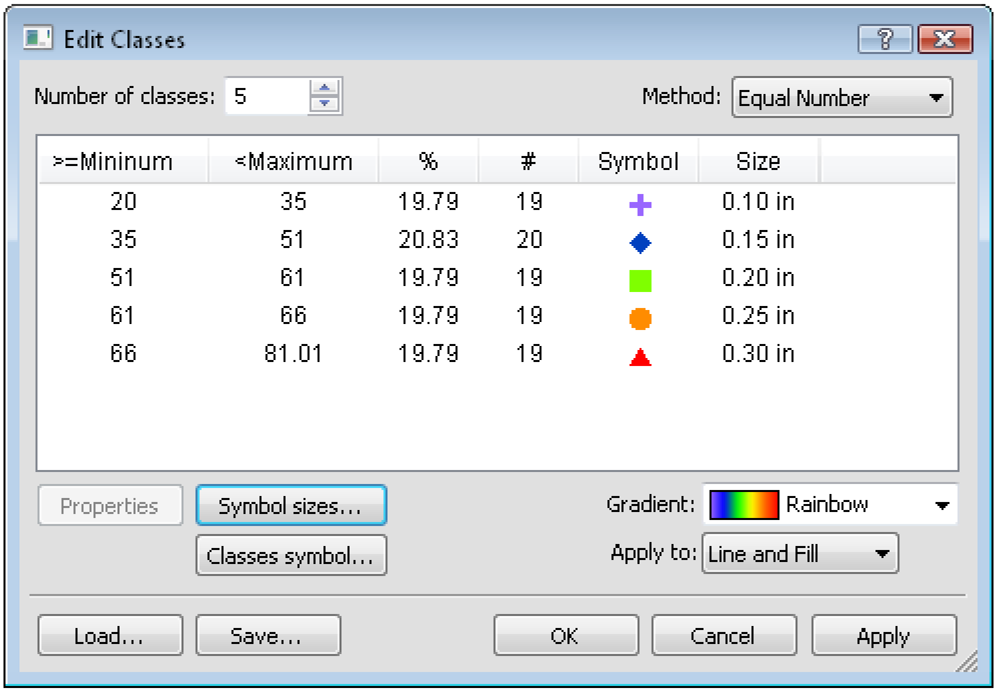
Projection Lines

Projection lines are also available for 3D XYZ plots. Projection lines are 2D representations of the 3D lines and appear on the various axis walls. Check the boxes next to the *Back projection*, *Side projection*, or *Bottom projection* options to add one, two, or all three of these projection lines to the graph. The *Back projection* option places the XY projection on the back wall of the graph. The *Side projection* option places the YZ projection on the side wall. The *Bottom* projection places the XZ projection on the bottom wall.

The projection line properties can be controlled in the *Projection line properties* section on the Line page. Click the ⊞ next to the *Projection line properties* section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the projection lines.

Edit Classes Dialog

The **Edit Classes** dialog allows you to define the classes used to group the data values in a classed scatter plot. Each class is represented by a unique symbol in the class scatter plot. Click on a class scatter plot in the Object Manager or the plot window to select it. In the Property Manager, open the **Plot** page. Click the *Edit*button next to the *Classes* option to open the **Edit Classes** dialog, which allows you to edit class information.



*Use the **Edit Classes** dialog to define the classes used to group the data values.*

Number of Classes

The *Number of classes* value is used to specify how many classes or groupings should be on the plot. When you change the *Number of classes* value, the class list box is automatically updated to reflect the change. The *Number of classes* must be a whole number from 1 to 300. To change the value, highlight the existing value and type a new value or click the  to increase or decrease the value.

When the *Class column* is numeric, a default number of classes is automatically created and all data points are displayed in one of the classes. When the *Class column* is a text string, the number of classes matches the number of unique text strings in the column where an X and Y value exist.

When the *Number of classes* is increased when the *Method* is set to *Name*, a new text class is automatically added if the *Class column* has any additional text items that are not currently a *Class Name*. If there are no more unique text strings in the column, a blank class is created.

Method

The *Method* specifies the method used to calculate the limits of each class:

- *Equal Number* assigns the class ranges such that approximately an equal number of points are included in each class. In this case, the interval of each class is usually different.
- *Equal Intervals* assigns the class ranges so the interval between the *>=Minimum* value and the *<Maximum* value is equal for each class. In this case, different numbers of points are usually assigned to each class.
- *Custom* allows you to set the *>=Minimum* value and the *<Maximum* value for each class. This allows you to specify your own ranges for the classes. Ranges defined in this way do not have to be contiguous. To change the *>=Minimum* or *<Maximum* value for any class, double-click the value in the class list. In the **Properties** dialog, set the values and the symbol property. Click *OK* to return to the **Edit Classes** dialog.
- *Name* sets the method to use a text string. Each unique text string in the *Class column* is a separate *Class Name*. When the *Method* is set to Name, there is a *Class Name* option. Double-click on any text in the *Class Name* column to edit the class properties in the **Properties** dialog. The *Class Name* option can be edited to any desired text. Unique text identifiers are not case sensitive. So, One, one, and ONE are all in the same group. Numbers are treated as text when the *Method* is set to *Name*.

Class List Box

The class list box displays summary statistics and allows you to specify the properties for each class:

- The *>=Minimum* column specifies the lower limit for each class of data. You can click the *Properties* button or double-click the number for any of the classes and change the value in the **Properties** dialog. The minimum value is included in this class.
- The *<Maximum* column specifies the upper limit for each class of data. You can click the *Properties* button or double-click the number for any of the classes and change the value in the **Properties** dialog. The maximum value is not included in the class.
- The *Class Name* column specifies the individual text entries for each class of data. You can click the *Properties* button or double-click the text for any of the classes and change the text in the **Properties** dialog. All text with the same text string are included in the class. Unique text identifiers are not case sensitive. So, *One, one,* and *ONE* are all in the same group.
- The *%* column indicates the percentage of data points in the particular class. This value cannot be edited and is for informational purposes only.
- The *#* column indicates the number of points included in each class.

This value cannot be edited and is for informational purposes only.

- The *Symbol* column displays the symbol used for each class. To change a symbol or symbol property used for a particular class, click the *Properties* button or double-click the symbol and change the value in the **Properties** dialog.
- The *Size* column displays the size of the symbol used for each class. To change the size, used for a particular class, click the *Properties* button or double-click the size and change the value in the **Properties** dialog.

Symbol Sizes

Click the *Symbol sizes* button to open the Symbol Sizes dialog. The **Symbol Sizes** dialog allows the size of all classes to be changed at the same time or allows for an incremental size to be set.

Classes Symbol

Click the *Classes symbol* button to open the Properties dialog. Set the *Symbol*, *Symbol set*, *Fill*, and *Line* properties for the symbol for all classes. Click *OK* and all classes update to show the selected symbol. This is useful if the same symbol should be used, but a variable color or size should be used for all classes.

Apply Gradient

The Apply Gradient command and list applies a color gradient to the class symbol line and/or fill colors.

First, specify which properties are being colored: the line, fill, or both. Click the currently selected option next to the *Apply Gradient...* button and select the desired option from the list:

- *to line and fill* sets both the line and fill color for each symbol as determined by the gradient.
- *to line* sets only the line color by the gradient. The fill color is set by the class color.
- *to fill* sets only the fill color by the gradient. The line color is set by the class color.

Next, Click *Apply Gradient* to select the gradient in the Color Gradient dialog. Click the current selection next to *Gradient* to select a predefined gradient. Click the  button to create a custom gradient. The *Gradient* is applied across all of the classes. The first class uses the minimum color in the gradient. The last class uses the last color in the gradient. All other classes are selected based on an equal number of intervals across the gradient.

To set the class color to something other than a gradient, double-click on the symbol in the *Symbol* column and change the color in the **Properties** dialog.

Load

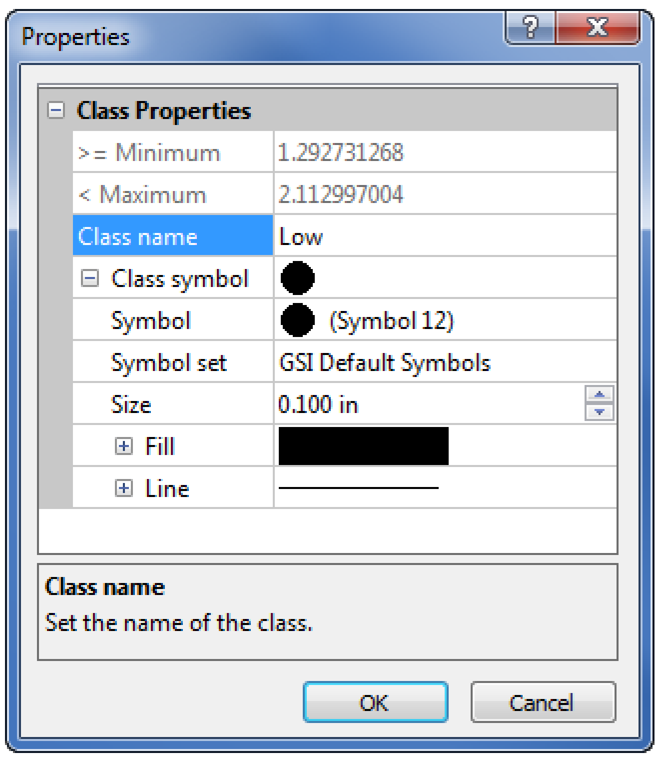
Click the *Load* button to open an existing classes .GCL file.

Save

Once all changes have been made in the **Edit Classes** dialog, click the *Save* button to save your entries as a new classes .GCL file.

Class Properties Dialog

The **Class Properties** dialog displays the properties for a class in a class scatter plot. The dialog is opened by clicking the *Properties* button in the Edit Classes dialog. The **Properties** dialog lists all of the properties for the selected class, including the *>=Minimum, <Maximum,Class name*, and *Class symbol* properties.



*The **Properties** dialog displays the properties for the selected class for a class scatter plot.*

>=Minimum

The *>=Minimum* value is the minimum value for the selected class. To change the minimum value, highlight the existing value and type a new number. Press ENTER on the keyboard to update the value. The minimum value is included in the class. This option is grayed out when the *Method* in the **Edit Classes** dialog is set to *Name*.

This option is not available when the *Classes symbol* button is clicked, as the symbol properties for all classes are set.

<Maximum

The *<Maximum* value is the maximum value for the selected class. To change the maximum value, highlight the existing value and type a new number. Press ENTER on the keyboard to update the value. The maximum value is not included in the class. This option is grayed out when the *Method* in the **Edit Classes** dialog is set to *Name*.

This option is not available when the *Classes symbol* button is clicked, as the symbol properties for all classes are set.

Class Name

The *Class name* option is grayed out when the *Method* in the **Edit Classes** dialog is set to *Equal Number, Equal Interval,* or *Custom*. The option is only available when the *Method* is set to *Name*. When available, the *Class name* displays the text associated with the text entry in the worksheet for this class. Capitalization is not important for the *Class name*. CLASS1 is the same as class1. Extra spaces or characters are important. So, class1 is not the same as class 1 or class1@. To change the text associated with any class, highlight the existing text and type the desired class text. The text displayed in the *Class name* is the same text displayed in the legend for this class.

This option is not available when the *Classes symbol* button is clicked, as the symbol properties for all classes are set.

Class Symbol

The *Class symbol* section contains the options to change the symbol properties for the selected class. The *Symbol, Symbol set, Size,* symbol *Fill* properties, and symbol *Line* properties options can be changed.

OK or Cancel

Click the *OK* button to accept the class changes. You are returned to the **Edit Classes** dialog. Click the *Cancel* button to return to the **Edit Classes** dialog without making the change.

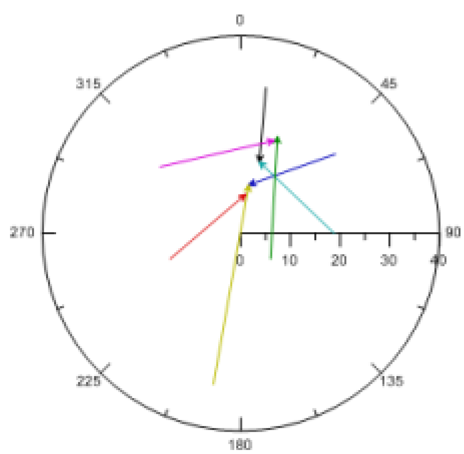
Polar Vector Plots

Click the **Home | New Graph | Polar | Polar 2-Point Vector Plot** or **Home | New Graph | Polar | Polar 1-Point Vector Plot** command to create a polar vector plot. Polar vector plots create vector lines between two points or from one point to the specified angle direction and with the selected magnitude.

Click the ***Polar 2-Point Vector Plot*** *or* ***Polar 1-Point Vector Plot*** *button to create a vector plot.*

2-Point Vector Plots are created from four data columns. Two columns specify the starting angle and radius location. Two other columns specify the ending angle and radius location. A straight line with a vector arrow is drawn between the two points.

1-Point Vector Plots are also created from four data columns. Two columns specify the starting angle and radius location. Two other columns specify the direction and magnitude of the vector. A straight line is drawn from the starting angle and radius location in the direction specified with a length of the magnitude.



Vector plots show data as straight-line segments.

Creating a New Polar Vector Plot

To create a polar vector plot:

1. Click the **Home | New Graph | Polar | Polar 2-Point Vector Plot** or **Home | New Graph | Polar | Polar 1-Point Vector Plot** command.
2. Select a worksheet file in the **Open Worksheet** dialog. You can select a new data file or you can select an open worksheet file in the *Open worksheets* section.
3. Click the *Open* button. A polar vector plot is created using the default properties.

Editing Polar Vector Plot Properties

To change the features of the polar vector plot— including the columns used to create the plot— first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

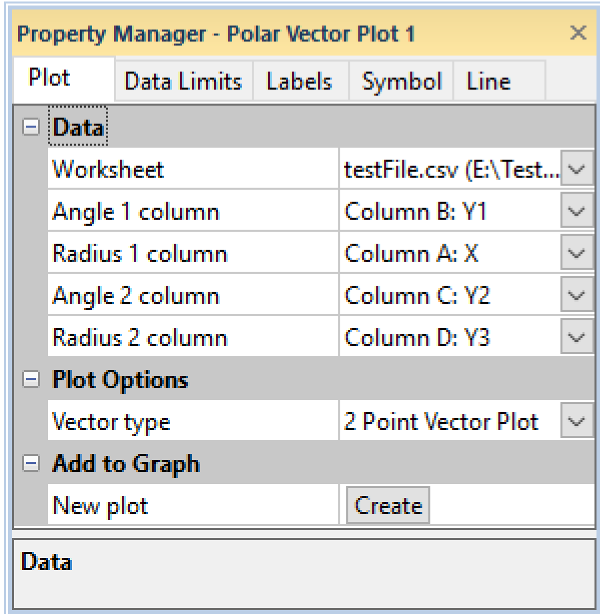
Labels

Symbol

Line

Plot Page - Polar Vector Plots

The polar vector plot properties **Plot** page contains the options to change the data file; set data used in the plot; and set vector properties. To view and edit polar vector plot properties, click on the polar vector plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the line/scatter plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the**Open Worksheet**dialog, and click the*Open*button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *Angle 1 column*, *Radius 1 column*, *Angle 2 column*, *Radius 2 column, Direction column,* or *Magnitude column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Vector Type

Click the *Vector type* field to choose the format in which to display the vector data.

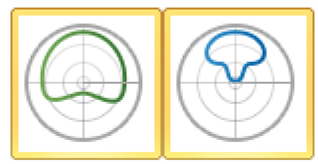
For a polar vector plot, the choices are *1-Point Vector Plot* and *2-Point Vector Plot.* The *2 Point Vector Plot* option contains two Angle and Radius positions. The polar vectors are drawn with a straight line between the two Angle and Radius locations. The *1 Point Vector Plot* option contains a starting Angle and Radius position and additional Direction and Magnitude values. The vectors are drawn from the Angle and Radius starting position to the point determined by the angle of the *Direction column* and with a length of the *Magnitude column*.

New Plot

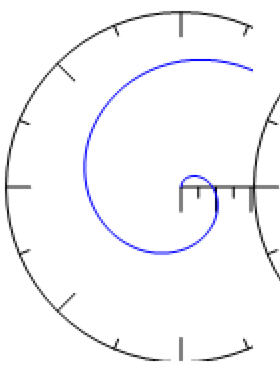
Click the *Create* button next to the *New plot* command to create a new plot based on the current data file. A new plot is created using the same *Angle 1 column* and *Radius 1 column* as the selected plot. The remaining data columns change to the next column in the worksheet that contains data. For example, if a selected vector plot uses column C for the *Angle 2 column* and column D for the *Radius 2 column*, clicking *Create* generates a new vector plot with column E for the *Angle 2 column* and column F for the *Radius 2 column*. The new polar vector plot is selected so you can change the new plot's properties.

Polar Function Plots

Click the **Home | New Graph | Polar | Function Plot** or the **Home | New Graph | Polar | Parametric Function Plot** command to display mathematical functions on a polar axis. No data files are required for this type of plot. You can plot R as a function of A or plot a parametric equation where R and A are functions of a third variable, T.

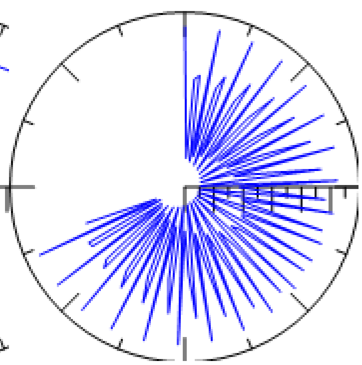


Click the **Function Plot** *or* **Parametric Function Plot** *buttons to create polar function plots.*



Polar function plots display functions on an angle axis. This polar function plot is displaying the parametric function

*R=F(T)=T and A=G(T)=2*T*



This polar function plot is displaying the function:

R=F(A)=Cos(A)+2

Creating a New Polar Function Graph

To create a polar function graph:

1. Click the **Home | New Graph | Polar | Function Plot** or the **Home | New Graph | Polar | Parametric Function Plot** command.
2. A polar function plot is created with the default equation. Use the**Property Manager**to customize plot properties.

Editing Polar Function Plot Properties

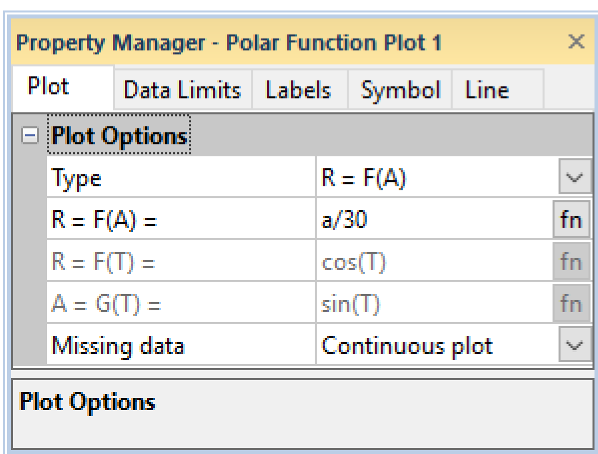
To change the features of a polar function plot, including the equations used to create the plot, first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot
Data Limits
Labels
Symbol
Line

Plot Page - Polar Function Plots

To view and edit function plot properties, click on the function plot in the Object Manager or plot window to select it. Click the **Plot** tab in the Property Manager. You can change the equation for the polar function plot.



*Change the polar function plot properties in the **PropertyManager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Type

The *Type* option determines if the plot is created with a set of equations or a single equation. When the *Type* field is set to *R = F(A)*, the function is entered in the form R as a function of A in the *R = F(A)* = field. If *Type* is set to *Parametric*, enter R and A as functions of T in the *R = F(T)* = and *A = G(T)* = fields.

Function

Enter the function equation in the *R = F(A)* = box. To change the equation, highlight the existing equation. Type a new equation in the box. Press ENTER on the keyboard to make the change.

For parametric equations, enter the A portion of the equation in the A = *G (T)* = box. Enter the R portion of the equation in the *R = F(T)* = box. To change the equation, highlight the existing equation. Type a new equation in the box. Press ENTER on the keyboard to make the change.

In both cases, you can click the 

button to open the Functions dialog and add predefined mathematical functions to the equation or you can type the functions into the fields manually.

Missing Data

Rows containing text or blanks in the plotted columns are ignored and are not plotted on the graph. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set. Data filtered using the *Criteria* settings are not included as missing data. *Missing data* is not available for all plot types.

Example 1

To create a polar function plot using the equation R=3-COS(A):

1. Create a new function plot by clicking the **Home | New Graph | Polar | Function Plot** command.
2. With the polar function selected, click the **Plot** tab in the Property Manager.
3. Highlight the contents of the *R = F(A)*= box and then type 3 -COS (D2R(A)). The function D2R(A) converts the angle in degrees to

radians, because the cosine function argument unit is radians.

4. Click the **Data Limits** tab.
5. Change the *First value* to 0.
6. Change the *Lastvalue* to 180.

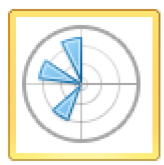
Example 2

To create a parametric function based on R = 2t and A = t^2 -1:

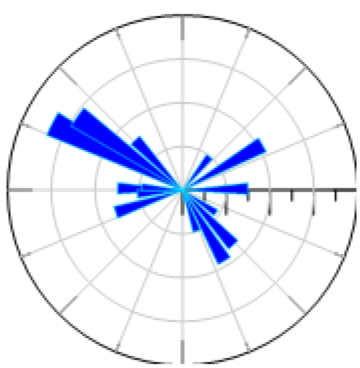
1. Create a new function plot by clicking the **Home | New Graph | Polar | Polar Function Plot** command.
2. Click the **Plot** tab in the Property Manager to access the *Plot Properties* page.
3. Highlight the contents of the *R = F(T)*= field and enter 2*T.
4. Highlight the contents of the *A= G(T)*= field and type t^2 - 1.
5. Click the **Data Limits** tab.
6. Change the *First value* to 0.
7. Change the *Lastvalue* to 25.

Polar Bar Charts

Click the **Home | New Graph | Polar | Polar Bar Chart** command to display data as bars drawn from the center of an angle axis to a data value. If more than one variable is used (multiple R values for each A value), the bars can be stacked on top of one another or they can be adjacent to each other. When adjacent bars are used the values are plotted side by side. When stacked bars are used, the total length of the stacked bars is equal to the sum of the data values.



*Click the **Polar Bar Chart** button to create a polar bar chart.*



Polar bar charts show bar chart data on an angular axis.

To create bars based on a group of R values, use a rose diagram instead.

Creating a New Polar Bar chart

To create a polar bar chart:

1. Click the **Home | New Graph | Polar | Polar Bar Chart** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A polar bar chart is created using the default properties.

Editing Polar Bar Chart Properties

To change the features of a polar bar chart, including the columns used to create the chart, first select the chart in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

Labels

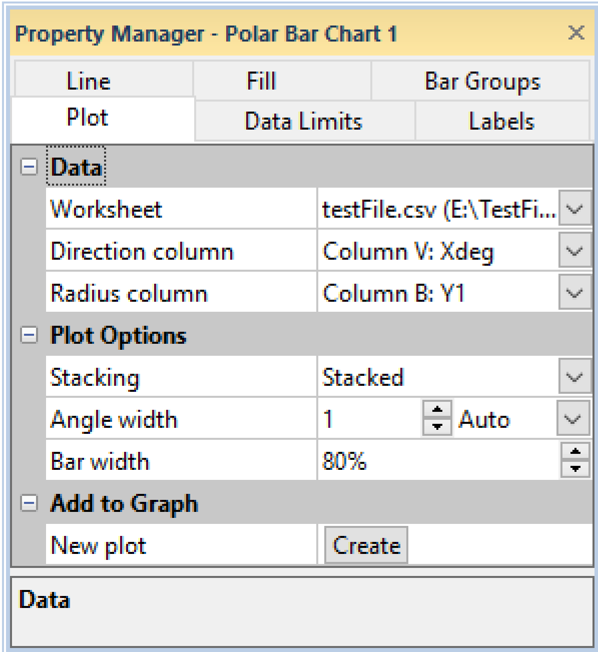
Line

Fill

Bar Groups

Plot Page - Polar Bar Charts

The polar bar chart plot properties **Plot** page contains the options to change the data file and columns; add a new plot to the graph; and set bar chart properties. To view and edit bar chart plot properties, click on the bar chart plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



The polar bar chart properties are edited in the ***PropertyManager*** *on the* ***Plot*** *tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *Direction column*, and *Radius column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

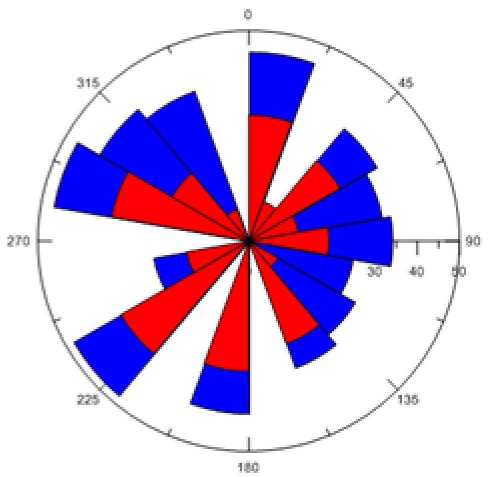
- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

When changing the *Direction column* or *Radius column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the columns to a numeric column from a date/-time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

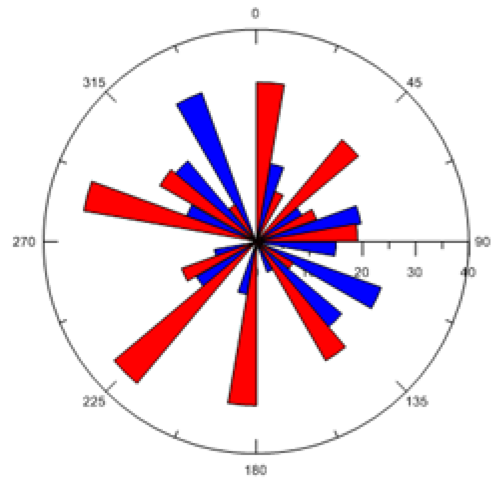
NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Plotting Multiple Variables

If multiple variables are plotted, the bars can be stacked or adjacent. Change the *Stacking* option to either *Stacked* or *Adjacent*. This setting affects all polar bar charts in a single bar chart group when multiple bar charts are plotted on one graph. To change the *Stacking* option, click on the existing option. In the list, select the new option.



These bars are stacked. The second bar is placed starting at the top of the first bar.



These bars are adjacent. The bars are located side by side.

Adjacent

The *Adjacent* option draws variables as a group of bars. The group of bars for each Angle value are centered on the Angle value data value.

Stacked

The *Stacked* option draws all the variables one on top of the other. The base for additional variables are the ends of the previous variables. The total height of a stacked bar is the sum of all variables (Radius values) for each Angle value.

For example, there are three variables with the Radius values 10, 15, and 20. The first bar would be drawn from zero to 10. The next bar would be drawn from 10 to 25, and the final bar would be drawn from 25 to 45.

Angle Width

The *Angle width* option sets the width of the polar bars. When the *Angle width* is set to *Auto,* the angle width is automatically calculated to fill the entire polar plot area. The wedges are adjusted to insure that the start point of each wedge is always in the center of the plot. The *Angle width* is set in degrees and must be a value between 0.1 and 90 degrees. To change the *Angle width*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  next to the value to increase or decrease the value. To return the value to the default, click the word *Custom* . It will automatically change to *Auto* and return the value to the default.

Bar Width

The *Bar width* field controls all of the bars in the graph in the same bar chart group. Set the width of the bars from 1 to 50000 percent. The default width is 80 percent. The 100 percent width is determined by the range of the X values. When the *Barwidth* is set to 100 percent, the bars touch and cover 100 percent of the data range. When the *Bar width* is set to 50 percent, the bars cover 50 percent of the data range and there are gaps between the bars. When the width is set to a value greater than 100 percent the bars overlap. This setting affects all bar charts when multiple bar charts are plotted on one graph. To change the value, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the next to the value to increase or decrease the value.

New Plot

Click the *Create* button next to the *New plot* command to create a new polar bar chart based on the current data file. A new chart is created using the same *Angle column* as the selected chart and the next column for the *Radius column*. For example, if a selected bar chart uses column A for Angle values and column B for Radius values, clicking *Create* generates a new bar chart with column A for Angle values and column C for Radius values. The new chart is selected so you can change the new chart's properties.

The new polar bar chart is automatically added to the same bar chart group as the first bar chart. The line, fill, and/or symbol color automatically changes to a new color. The *Plot palette* option on the **Options** dialog Plots page controls the colors for plots added via the *Create* button in the **Plot** page.

Bar Chart Groups

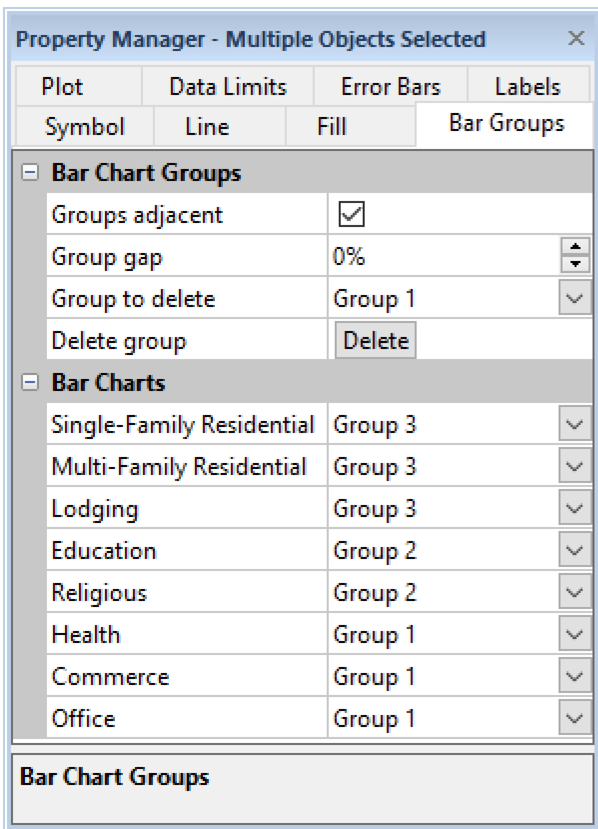
The **Bar Groups** page in the Property Manager is used to create bar chart groups. The bars within a group can be stacked or adjacent. The bar chart groups are drawn adjacent or overlapping. Ungrouped bar charts are always drawn overlapping grouped bars. Grouping various bar charts and changing the bar chart order in the **Object Manager** can provide interesting intra- and intergroup comparisons.

Drawing Order

Groups are drawn in order by group number. Group 1 is drawn first, Group 2 is drawn next, etc. Groups are plotted from left to right in vertical bar charts and from bottom to top in horizontal bar charts when the groups are plotted adjacent. The groups are drawn in order from back to front when groups are not plotted adjacent, i.e. the last group to be drawn will be visible when groups overlap.

Within groups, the draw order is determined by the bar chart order in the Object Manager. Bar charts that are lower in the **Object Manager** (earlier in the draw order) are plotted at the bottom of stacks, towards the left of adjacent vertical bars, or towards the bottom of adjacent horizontal bars. Conversely, bar charts that are higher in the **Object Manager** (later in the draw order) are plotted at the top of stacks, towards the right of adjacent vertical bars, or towards the top of adjacent horizontal bars.

Experiment with both the bar chart order in the **Object Manager** and the group number for the bar charts to determine the best presentation for your grouped bar charts.

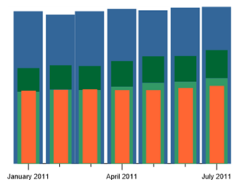


*The **Bar Chart** tab in the **Property Manager** defines the bar groups.*

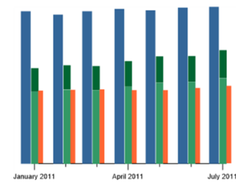
Groups Adjacent

The *Groups adjacent* property specifies whether groups are plotted adjacent to other groups or overlaid with other groups at the same location.

Check the *Groups adjacent* box to plot to groups adjacent to one another. When the *Groups adjacent* box is not checked, the groups will overlap. Groups cannot be plotted adjacent to one another with the Polar Bar Chart.



This example includes four bar charts in three groups. The two green bars are grouped and stacked. When Groups adjacent *is not checked the bars are drawn overlapping.*



This example shows the same bar charts with Groups adjacent selected*. The entire bar is visible in every month.*

Group Gap

The *Group gap* property specifies the space between groups when groups are adjacent, i.e. *Groups adjacent* is checked. Set the gap between bars from 0 to 5000 percent. The default setting is no gap between the groups. The gap size percentage is determined by the range of the X values. To change the value, either highlight the existing value and type a new value or click the to scroll to a new number. Press ENTER on the keyboard to update the plot.

Delete Group

The *Group to delete* optionand the *Delete group* command are used to remove a group. First, select the group you wish to remove in the *Group to delete* field. Next click *Delete* to remove the bar chart group. Any bar charts in the deleted group will become ungrouped.

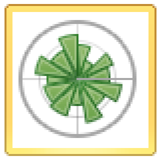
Bar Chart List

The *Bar Charts* section of the **Bar Groups** page includes all the bar charts in the graph and the group(s) to which the bar charts belong.

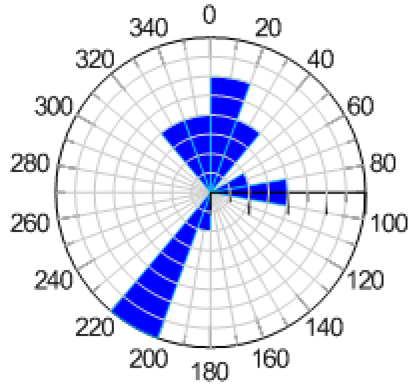
To move a bar chart into a different group, click the current group for a bar chart and select the desired group from the list. To make a bar chart ungrouped, select *None* from the list. Select *New Group* to add a new bar chart group to the list.

Polar Rose Chart

Click the **Home | New Graph | Polar | Polar Rose Chart** command to display data in groups or bins, similar to histograms. Each bin represents the number of occurrences of an event that fall within a specific angular region, defined by the bin size.



*Click the **Polar Rose Chart** button to create a polar rose diagram.*



Rose charts show binned data similar to histograms.

Creating a New Polar Rose Chart

To create a rose chart:

1. Click the **Home | New Graph | Polar | Polar Rose Chart** command
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A rose chart is created using the default properties.

Editing Polar Rose Chart Properties

To change the features of a rose diagram, including the column used to create the diagram, first select the diagram in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

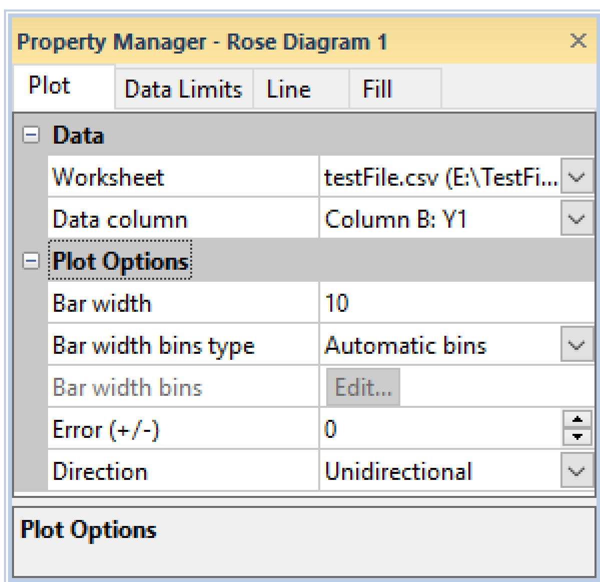
Data Limits
Line
Fill

Clipping on Polar Rose Chart

Rose charts are always clipped at the radius axis maximum value. If the rose chart bin value is greater than the axis maximum, the rose chart will be drawn to the axis maximum and stop. To display the entire bin, set the radius axis maximum value to Automatic.

Plot Page - Polar Rose Chart

The rose diagram plot properties **Plot** page contains the options to change the data file; set the bin size; set the error width; and set bar properties. To view and edit rose diagram plot properties, click on the rose diagram plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*The rose diagram options are edited in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *Data column* field to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Bar Width

The *Bar width* controls the range of angle values contained in each bar in the rose diagram, i.e. the automatic bin size. The *Bar width* is shown in degrees. To change the *Bar width*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. The *Bar width* is not available when the *Bins type* is set to *Custom bins*.

The first automatic bin always includes zero. Each additional bin begins at slightly greater than the next bin value, which is calculated by adding the zero and the *Bar width*. All bins include the maximum value for that bin.

The exception is the last bin. The last bin is slightly greater than the minimum value and slightly less than 360. 360 is calculated as zero in the automatic bins.

For example, if the *Bar width* is 10, the first bin includes the values 0 and 10. The next bin would include any values greater than 10 and less than or equal to 20. The third bin would include any values greater than 20 and less than or equal to 30. The last bin would include any values greater than 350 and less than 360.

Bins Type

Rose diagram bins can be automatic or custom. Automatic bins use the value in the *Bar width* propertyto determine the bin size of each bar. To change the *Bar width bins type*, click on the current option and select the desired option from the list.

Setting the *Bar width bins type* to *Automatic bins*results in adjacent bars that cover all the data in the polar circle. Setting the *Bar width bins type* to *Custom bins*, allows the user to set the minimum and maximum value for each bin individually. To create custom bins, change the *Bar width bins type*to*Custom bins*. Click *Edit* in the *Bar width bins* field to set the custom values.

Custom Bins

To set the bin ranges individually select *Custom bins* from the *Bar width bins type* list and then click *Edit* next to *Bar width bins* to open the Custom Bins dialog.

Error

The *Error (+/-)* field plots an arc with a width that is twice the specified *Error (+/-)* value. This allows you to set an error bar around the data that has been plotted. This is especially useful when plotting single points with an error distribution. For example, if 5 degrees is the error estimate, error bars that are 10 degrees wide are created and centered over each of the bars. The *Error (+/-)* property is not available when the *Bins type* is set to *Custom bins*.

Click the ⊞ next to the *Error line properties* on the Line page to open the error bar line properties section. The line *Style, Color, Opacity*, and *Width* can be changed. Click the ⊞ next to the *Error fill style* on the Fill page to open the error bar fill properties section. The fill *Pattern, Foreground color, Foreground opacity, Background color, Background opacity, Scale,* and *Stretch* can be changed.

Direction

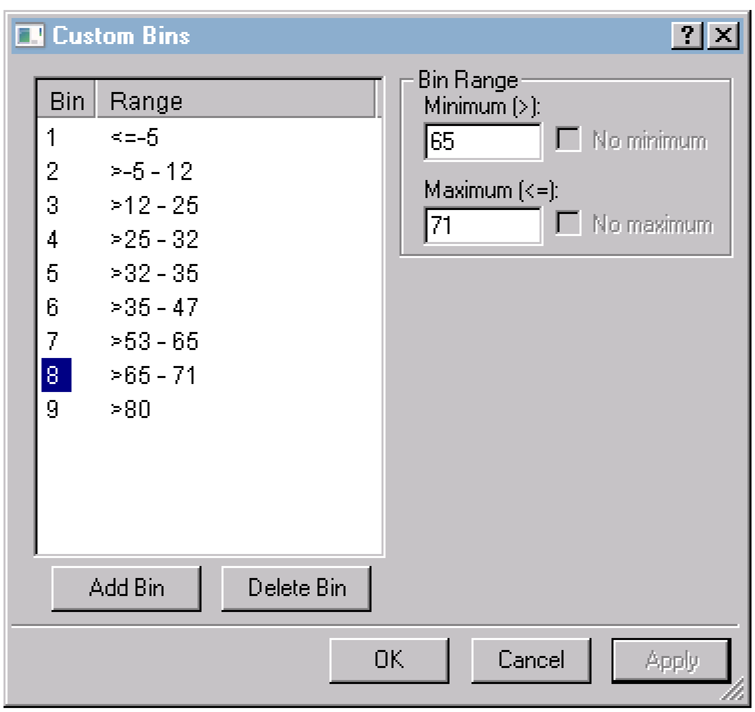
The *Direction*option sets how rose diagram bars are drawn. If *Uni-directional* is selected, the data is plotted only in the one direction specified in the worksheet. Selecting *Bidirectional* creates a mirror image of the data so the data is plotted in two directions. To calculate where the data is plotted using *Bidirectional*, add 180 degrees to the data value. As an example, if you have a bin size of 45 degrees and it starts at 0, there is a bin at 0-45 degrees and another bin mirrored at 180-225 degrees. To change the *Direction*, click on the current option and select the new option from the list.

Clipping on Polar Rose Chart

Rose charts are always clipped at the radius axis maximum value. If the rose chart bin value is greater than the axis maximum, the rose chart will be drawn to the axis maximum and stop. To display the entire bin, set the radius axis maximum value to Automatic.

Custom Bins

There are automatic and custom binning options in **Grapher**. Use the **CustomBins** dialog to define custom bins and labels when creating or editing a histogram, rose diagram, wind chart, and 3D histogram.



Set the histogram, rose diagram, or wind chart bin ranges in the ***Custom Bins*** *dialog.*

To Open the Custom Bins Dialog:

1. Select a histogram, rose chart, wind chart, or 3D histogram.
2. Click the **Plot** tab in the Property Manager.
3. Set the *Bins type* to *Custom bins*.
4. Click the *Edit* button next to *Bins* to open the **Custom Bins** dialog.

Minimum

The value in the *Minimum (>)* box indicates the minimum value for the selected bin. This value is not included in the bin. To change the *Minimum*value, highlight the existing value and type a new number.

No Minimum

Check the *No minimum* box if this is the first bin in the plot. If the *No minimum* box is checked, all values less than or equal to the value in the *Maximum* box will be included in this bin. After the box is initially checked, it is disabled for all other bin definitions.

Maximum

The value in the *Maximum (<=)* box indicates the maximum value for the selected bin. This value is included in the bin. To change the *Maximum*value, highlight the existing value and type a new number.

No Maximum

Check the *No maximum* box if this is the last bin in the plot. If the *No maximum* box is checked, all values greater than the value in the *Minimum* box will be included in this bin. After the box is initially checked, it is disabled for all other bin definitions.

OK or Cancel

Click *OK* to make the custom bin changes and return to the plot window. Click *Cancel* to return to the plot window without making the change.

To Create Customized Bins:

1. In the **Custom Bins** dialog, click the *Add Bin* button.
2. In the New Bin Range dialog, enter the bin minimum and maximum and click the *OK* button.
3. Click the *Add Bin* button and follow steps 1 and 2 above until all bins

have been added.

4. Click the *OK* or *Apply* button to draw the custom bins.

To Edit Customized Bins:

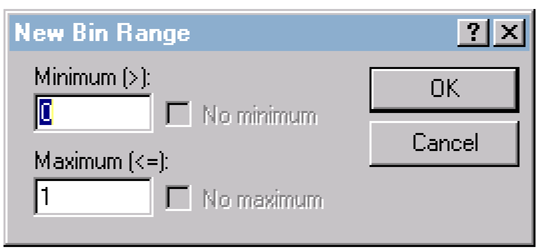
1. In the **Custom Bins** dialog, click on the bin number in the list on the left side of the dialog.
2. Change the bin minimum or maximum in the *Bin Range* section.
3. Click the *OK* or *Apply* buttons to draw the new bin.

To Delete a Bin:

1. In the **Custom Bins** dialog, click on the bin number in the list on the left side of the dialog.
2. Click the *Delete Bin* button.
3. Click the *OK* or *Apply* buttons to draw the new bins.

New Bin Range Dialog

The **New Bin Range** dialog appears when setting custom bin values for a histogram, 3D histogram, rose diagram, or wind chart. This dialog allows each bin to have a custom defined minimum and maximum value. It also allows the number of bins to be customized.



*The **New Bin Range** dialog sets the minimum and maximum values for a custom bin.*

To open the **New Bin Range** dialog,

1. Select a histogram, rose diagram, wind chart, or 3D histogram.
2. Click the **Plot** tab in the Property Manager.
3. Set the *Bins type* to *Custom bins*.
4. Click the *Edit* button next to *Bins* to open the Custom Bins dialog.
5. In the **Custom Bins** dialog, click the *Add Bin* button to open the **New Bin Range** dialog.

Minimum

The value in the *Minimum (>)* box indicates the minimum value for the selected bin. This value is not included in the bin. To change the *Minimum*value, highlight the existing value and type a new number.

No Minimum

Check the *No minimum* box if this is the first bin in the plot. If the *No minimum* box is checked, all values less than or equal to the value in the *Maximum* box will be included in this bin. After the box is initially checked, it is disabled for all other bin definitions.

Maximum

The value in the *Maximum (<=)* box indicates the maximum value for the selected bin. This value is included in the bin. To change the *Maximum*value, highlight the existing value and type a new number.

No Maximum

Check the *No maximum* box if this is the last bin in the plot. If the *No maximum* box is checked, all values greater than the value in the *Minimum* box will be included in this bin. After the box is initially checked, it is disabled for all other bin definitions.

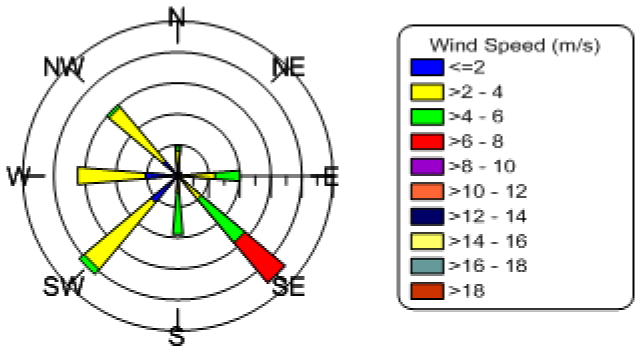
OK or Cancel

Click *OK* to make the change to the selected bin and return to the **Custom Bins** dialog. Click *Cancel* to return to the **Custom Bins** dialog without making the change.

Polar Wind Charts

Click the **Home | New Graph | Polar | Polar Wind Chart** command to display wind data, although you can use this graph type with other types of data. In a wind chart, each bin represents the number of times wind flows from a given direction. The direction is divided up into bins, and each bin contains separation of the data into wind speeds. Therefore, the number of times wind comes from a given direction and the speed of the wind is given in each bin.

*Click the **Polar Wind Chart** button to create a polar wind chart.*



Wind charts show data grouped into bins and then categorized within each bin.

Creating a New Polar Wind Chart

To create a wind chart:

1. Click the **Home | New Graph | Polar | Polar Wind Chart** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A wind chart is created using the default properties.

Editing Polar Wind Chart Properties

To change the features of a wind chart, including the columns used to create the chart, first select the chart in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

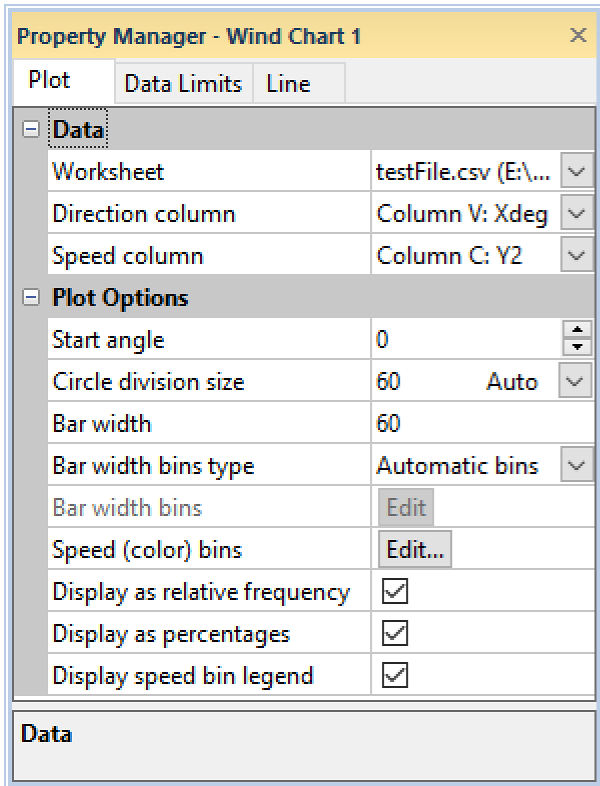
Line

Clipping on Polar Wind Chart

Wind charts are always clipped at the radius axis maximum value. If the wind chart bin value is greater than the axis maximum, the wind chart will be drawn to the axis maximum and stop. To display the entire bin, set the radius axis maximum value to Automatic.

Plot Page - Wind Charts

The wind chart plot properties **Plot** page contains the options to change the data file; set the bin size; set the wind speed bins; and set bar properties. To view and edit wind chart plot properties, click on the wind chart plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*The wind chart options are edited in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click

on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *Direction column* field and the *Speed column* field to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Bin Start Angle

The *Start angle* field shows the beginning number for the first bin. This value is in degrees. By default, this value is 0. To change the value, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. By changing the starting location you can create a bin which overlaps the 0 degree direction. For example, if you are using bins 20 degrees in size, setting the *Start angle* value to 10 degrees results in the final bin covering the arc from 350 to 10 degrees.

Circle Division Size

The *Circle division size* field controls the "width" of the bin. The arc size is shown in degrees. To change the *Circle division size*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. When *Auto* is selected for the *Circle division size*, the arc size is the same as the *Bin size*. To return the *Circle division size* to the default value, click on the word *Custom* and select *Auto* from the list. The value automatically change to equal the *Bin size*. The *Arc size* must be equal to or smaller than the *Bin size*.

Bar Width

The *Bar width* controls the range of angle values contained in each bar in the rose diagram, i.e. the automatic bin size. The *Bar width* is shown in degrees. To change the *Bar width*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. The *Bar width* is not available when the *Bins type* is set to *Custom bins*.

The first automatic bin starts at the *Start angle*. Each additional bin begins at slightly greater than the next bin value, which is calculated by adding the *Start angle* and the *Bar width*. All bins include the maximum value for that bin.

Direction Bins Type

Wind chart direction bins can be automatic or custom. Automatic bins use the value in the *Bar width* option to determine the bin size of each bar. To change the *Bar width bins type*, click on the current option and select the desired option from the list.

Setting the *Bar width bins type* to *Automatic bins*results in adjacent bars that cover all the data in the polar circle. Setting the *Bar width bins type* to *Custom bins*, allows the user to set the minimum and maximum value for each bar individually. To create custom bins, change the *Bar width bins type*to*Custom bins*. Click the*Edit*button next to the*Bar width bins*command to set the custom values.

Custom Bins

To set the bin ranges individually select *Custom bins* from the *Bins type* list and then click the *Edit*button next to *Bar width bins* to open the Custom Bins dialog.

Speed Bins

To set the wind speed ranges and colors in the Wind Speed Bins dialog, click the *Edit* button next to *Speed (color) bins*.

Relative Frequency

To display data values as relative frequency rather than the total number of observations in a bin, select the *Display as relative frequency* option. When this box cleared, bars display the total number of counts from the *Data column* in each bin.

Display As Percent

To display wind chart data values as percentages rather than decimal numbers on the radial axis, check the box next to the *Display as percentages* option. When this box is checked, the values are displayed in the form of n%. This option is only available when the *Display values as relative frequency* box is checked.

Legend

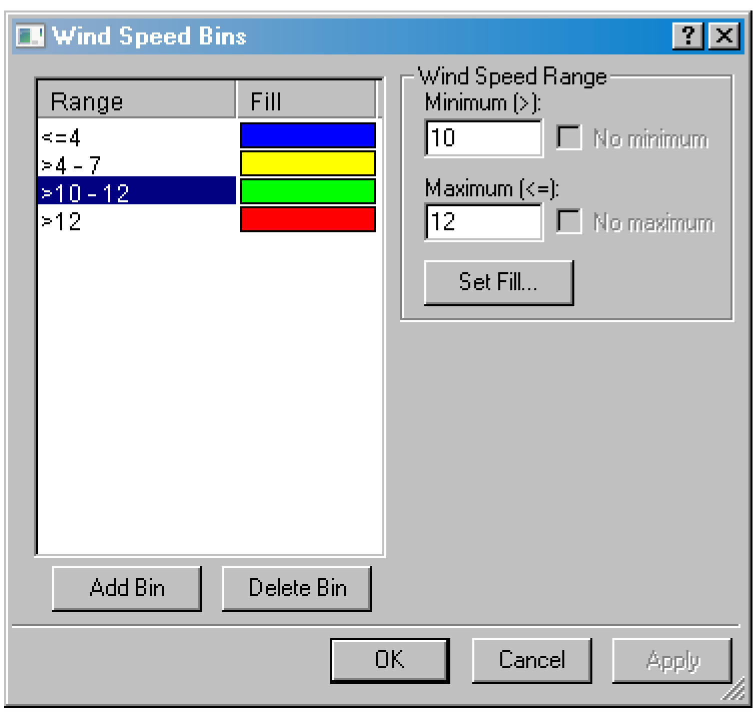
Check the box next to the *Display speed bin legend* option to show the wind chart legend. The contents of the legend (wind speed ranges) are determined in the Wind Speed dialog. You can edit the legend to include titles, to change the line properties, legend fill, and text properties.

Clipping on Polar Wind Chart

Wind charts are always clipped at the radius axis maximum value. If the wind chart bin value is greater than the axis maximum, the wind chart will be drawn to the axis maximum and stop. To display the entire bin, set the radius axis maximum value to Automatic.

Wind Speed Bins

Use the wind chart**Wind Speed Bins** dialog to define wind speed ranges.



*Define wind speed ranges in the **Wind Speed** dialog.*

To Open the Wind Speed Bins Dialog:

1. Select a wind chart.
2. Click the **Plot** tab in the Property Manager.
3. Click the *Edit*button next to *Speed bins* to open the **Wind Speed Bins** dialog.

Minimum

The value in the *Minimum (>)* box indicates the minimum value for the selected bin. This value is not included in the bin. To change the *Minimum*value, highlight the existing value and type a new number.

No Minimum

Check the *No minimum* box if this is the first bin in the plot. If the *No minimum* box is checked, all values less than or equal to the value in the *Maximum* box will be included in this bin. After the box is initially checked, it is disabled for all other bin definitions.

Maximum

The value in the *Maximum (<=)* box indicates the maximum value for the selected bin. This value is included in the bin. To change the *Maximum*value, highlight the existing value and type a new number.

No Maximum

Check the *No maximum* box if this is the last bin in the plot. If the *No maximum* box is checked, all values greater than the value in the *Minimum* box will be included in this bin. After the box is initially checked, it is disabled for all other bin definitions.

OK or Cancel

Click the OK button to make the custom wind speed bin changes and return to the plot window. Click *Cancel* to return to the plot window without making the change.

To Create Customized Speed Bins:

1. In the **Wind Speed Bins** dialog, click the *Add Bin* button.
2. In the New Bin Range dialog, enter the bin minimum and maximum and click the *OK* button.
3. Click the *Add Bin* button and follow steps 1 and 2 above until all bins

have been added.

4. Click the *OK* or *Apply* button to draw the custom bins.

To Edit Customized Speed Bins:

1. In the **Wind Speed Bins** dialog, click on the *Range* in the list on the left side of the dialog.
2. Change the bin minimum or maximum in the *Wind Speed Range* section.
3. Click the *OK* or *Apply* buttons to draw the new bin.

To Delete a Speed Bin:

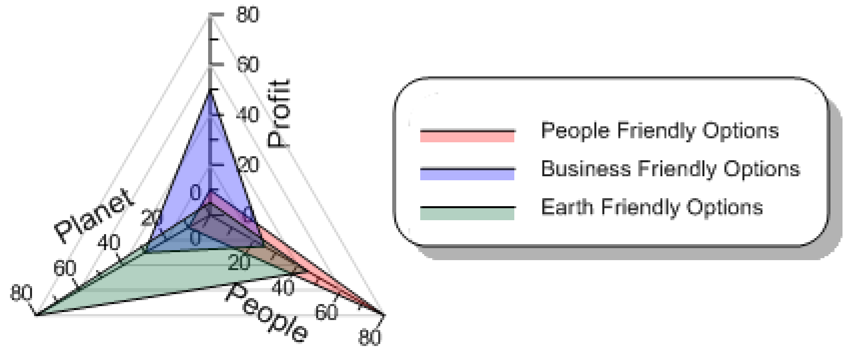
1. In the **Wind Speed Bins** dialog, click on the *Range* in the list on the left side of the dialog.
2. Click the *Delete Bin* button.
3. Click the *OK* or *Apply* buttons to draw the new bins.

Radar Charts

Click the **Home | New Graph | Polar | Radar Chart** command to create a radar plot. A radar plot is often referred to as a spider plot. The radar plot has a similar appearance to other radial graphs, except there are multiple radii axes. There is no angle axis.

*Click the **Radar Chart** button to create a polar radar plot.*

A radar chart is a graphical method of displaying multivariate data in the form of a two-dimensional chart of three or more quantitative variables represented on axes starting from the same point. The relative position and angle of the axes is typically uninformative. The radar plot is also known as a spider chart, a web chart, a star plot, and an irregular polygon chart.



A radar plot is used to display multivariate data.

The radar chart is a chart and or plot, that consists of a sequence of equi-angular spokes, called radii, with each spoke representing one of the variables. The data length of a spoke is proportional to the magnitude of the variable for the data point relative to the maximum magnitude of the variable across all data points. A line is drawn connecting the data values for each spoke. The radar can be used to answer questions such as; What variables are dominant for a given observation? Which observations are most similar? Is there a cluster of observations? Are there outliers?

Radar charts are a useful way to display multivariate observations with an arbitrary number of variables. Each observation is represented as a star shaped figure with one ray for each variable. For a given observation, the length of each ray is made proportional to the size of that variable. Radar charts can be used to examine the relative values for a single data point and to locate similar points or dissimilar points.

Creating a New Radar Plot

To create a radar plot

1. Click the **Home | New Graph | Polar | Radar Chart** command.
2. Select a data file in the**Open Worksheet**dialog.
3. Click the *Open* button. A radar plot is created with the default properties.

Radar plots will be created with the same line and symbol color for all plots when created from the **Home | New Graph** command. Create a radar plot from the Graph Wizard to automatically apply different colors to the plots.

Editing a Radar Plot

Radar plot display properties are controlled by selecting the radar plot. Unlike most plots, radar plots do not have a **Plot** page in the Property Manager. Properties such as the data file, included columns, and worksheet rows can be controlled by selecting the graph object and clicking the Graph page.

To change the features of a radar plot, first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Labels

Symbol

Line

Fill

Editing a Radar Plot Graph

Some features of the radar plot are controlled by the graph object. To change these features, first select the graph in the plot window or **Object Manager**. Edit the properties in the **Property Manager**.

Click the following tabs in the **Property Manager** to change different properties:

Graph

Title

Line

Fill

Radar Plot References

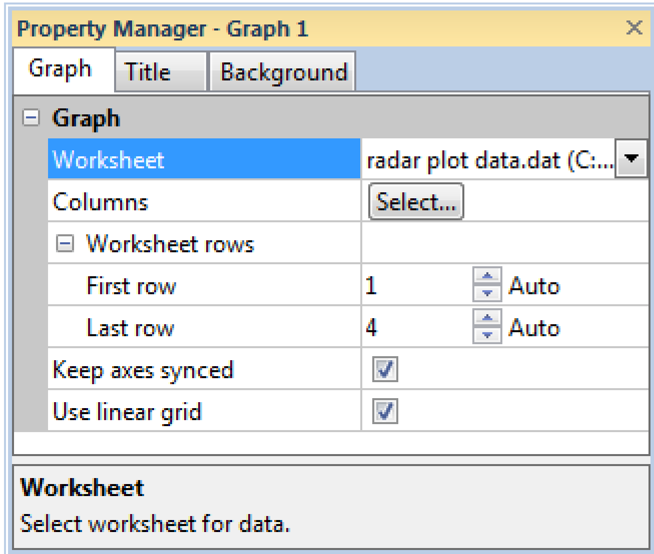
Chambers, John, William Cleveland, Beat Kleiner, and Paul Tukey, (1983). *Graphical Methods for Data Analysis*. Wadsworth. pp. 158-162

NIST/SEMATECH (2003). Star Plot in: *e-Handbook of Statistical Methods*. 6/01/2003

Mayr, Georg von (1877). Die Gesetzmäßigkeit im Gesellschaftsleben. Oldenbourg. p.78.

Graph Page - Radar Plot

The **Graph** page of the Property Manager sets the graph properties for radar plots. To view the properties on the **Graph** tab, click on the *Graph* object in the Object Manager. In the **Property Manager**, click on the **Graph** tab.



*The **Graph** tab for a selected radar plot graph contains options for setting the radar graph properties.*

Worksheet

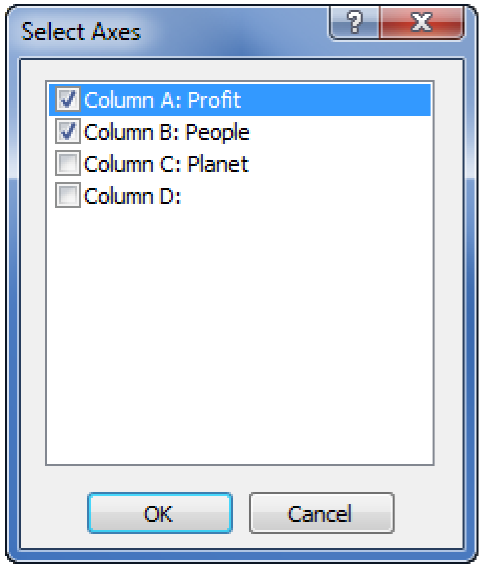
Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the**Open Worksheet**dialog, and click the*Open*button to change the data. The plot automatically updates.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Columns

Click the *Select* button next to *Columns* to open the **Select Axes** dialog. In the dialog, a list of available columns in the selected worksheet are displayed. A check mark next to a column indicates the column of data will be used in the plot. To add a column, click in the box to the left of the column name. A check mark will be added to the box. To remove a column, click in the box to the left of the column name. The check mark will be removed. When finished selecting all columns, click *OK* to make the change active. Click *Cancel* to return to **Property Manager** with the previous column list.



In this example, columns A and B are included in the radar plot. Columns C and D are not.

Worksheet Rows

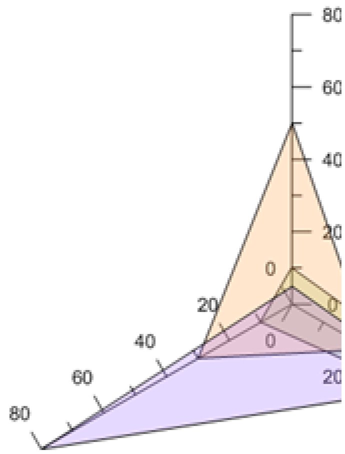
Select the range of rows to plot in the *Worksheet rows* section. Click the ⊞ next to *Worksheet rows* to open the *Worksheet rows* section. The default rows are the first and last rows in the worksheet that contain data.

If *Auto* is selected for the *First row* and *Last row*, all of the rows containing data are used. To limit the range of the plotted data, you can change the range of rows. Next to *First row* or *Last row,* click the word *Auto* and select *Custom*. You can then enter a new row number into either the *First row* and *Last row* boxes. To change the value, either highlight the existing row number and type a new row number or click the to scroll to a new row number. Press ENTER on the keyboard to update the plot.

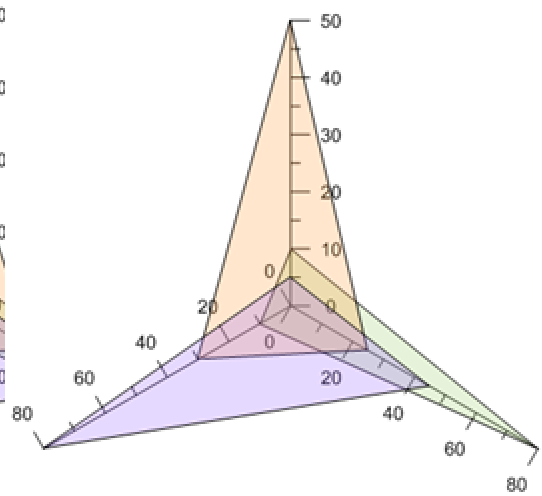
Click the word *Custom* and select *Auto* to go back to automatic row selection. The word*Auto*will appear and the*First row* or *Last row* will revert to the default row.

Keep Axes Synched

Check the box next to the *Keep axes synched* option to synchronize the radar plot axes. If the box is checked, then the axes are synchronized. This means that changes made to one axis will update all axes. If the box is not checked, then the axes are not synchronized. This means that changes made to one axis will only update the selected axis. Using synched axes often makes visual comparison between variables easier. You can immediately see in the graph below that the variable pointing directly up does not have as much affect as the other two variables when the axes are synched.



This radar plot contains synched axes. All axes go from zero to 80 units.

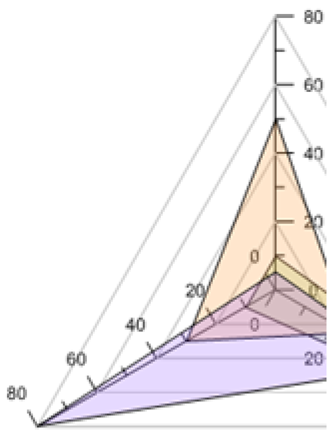


This radar plot does not contain synched axes. The upper axis does not have the same extents as the other two axes.

Use Linear Grid

Check the *Use linear grid* option to create linear grid lines when the axis grid lines are on. Clear the box next to the *Use linear grid* option to create circular grid lines when the axis grid lines are on.

To turn on axis grid lines, click on a radar axis to select it. Click on the Line tab in the **Property Manager**. Check the box next to the*Major tick grid line*option,*Minor tick grid line*option, or*Worksheet grid line*option.

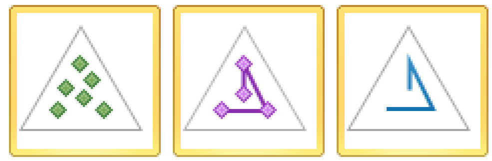


This radar plot uses a linear grid. Grid lines directly connect axes with straight lines.

This radar plot does not use a linear grid. Grid lines connect axes with curved lines, similar to the angle axis.

Ternary Line, Scatter, and Line/Scatter Plots

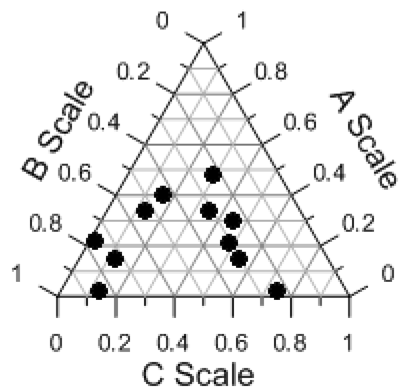
Click the **Home | New Graph | Ternary | Ternary Scatter Plot**, **Home | New Graph | Ternary | Ternary Line/Scatter Plot**, or **Home | New Graph | Ternary | Ternary Line Plot** command to represent relative percentages in a three component system. Ternary diagrams are frequently used in chemistry and earth sciences to illustrate rock classification schemes and depict chemical compositions on phase diagrams. For example, if you were analyzing the composition of a soil sample, you could use a ternary diagram to illustrate the relative percentages of three minerals found in the sample.



Click the **Ternary Scatter Plot**, **Ternary Line/Scatter Plot**, *or* **Ternary Line Plot** *buttons to create ternary diagrams with lines and symbols.*

To plot data on a ternary diagram, the sum of the three data points (X + Y + Z) in any row must equal 100 percent. If the sum does not equal 100 percent you must normalize your data so that it meets this requirement, otherwise **Grapher** normalizes the data when it is plotted. Once this relationship has been established between the data points, you need only know the values of any two data points in order to determine the third. Reading a point on a ternary diagrams can be done by looking at the location of each point as it relates to the three axes.

You can add a line connecting the points in a ternary diagram. The line connects the data in the order it appears in the data file. To add a line, open the Line tab in the Property Manager, and then select a line style other than *Invisible*.



Ternary diagrams show percentages in a three component system.

Creating a New Ternary Diagram

To create a ternary diagram:

1. Click the **Home | New Graph | Ternary | Ternary Scatter Plot**, **Home | New Graph | Ternary | Ternary Line/Scatter Plot**, or **Home | New Graph | Ternary | Ternary Line Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A ternary diagram is created using the default properties.

Editing Ternary Diagram Properties

To change the features of a ternary diagram, including the columns used to create the diagram, open the ternary diagram properties by selecting the ternary diagram and editing the properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

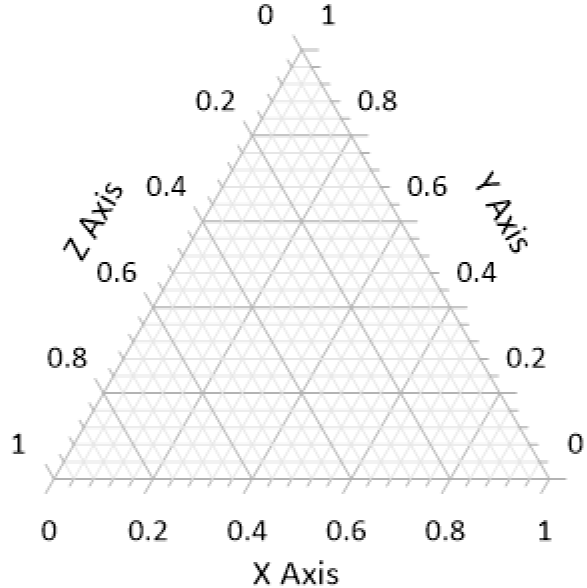
Labels

Symbol

Line

Reading Ternary Diagrams

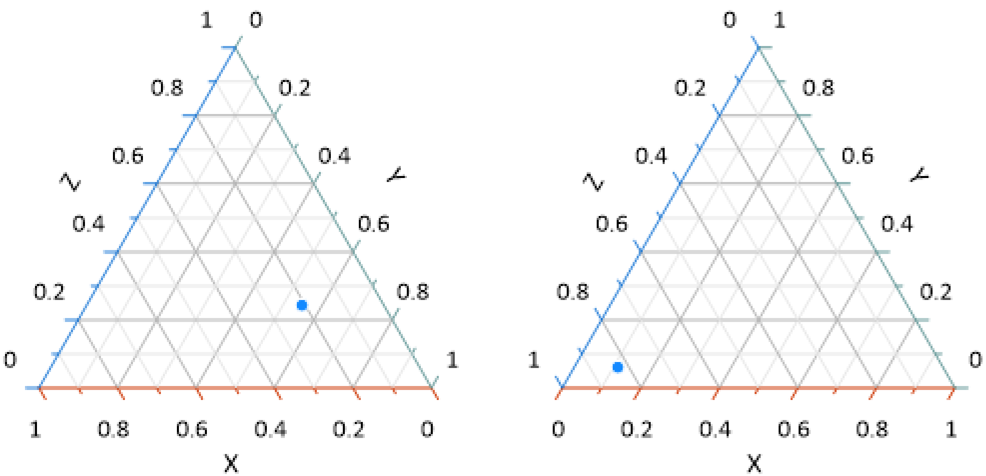
In Grapher, ternary axes are arranged with the X axis at the bottom of the plot, Y axis to the right of the plot, and Z axis to the left of the plot.



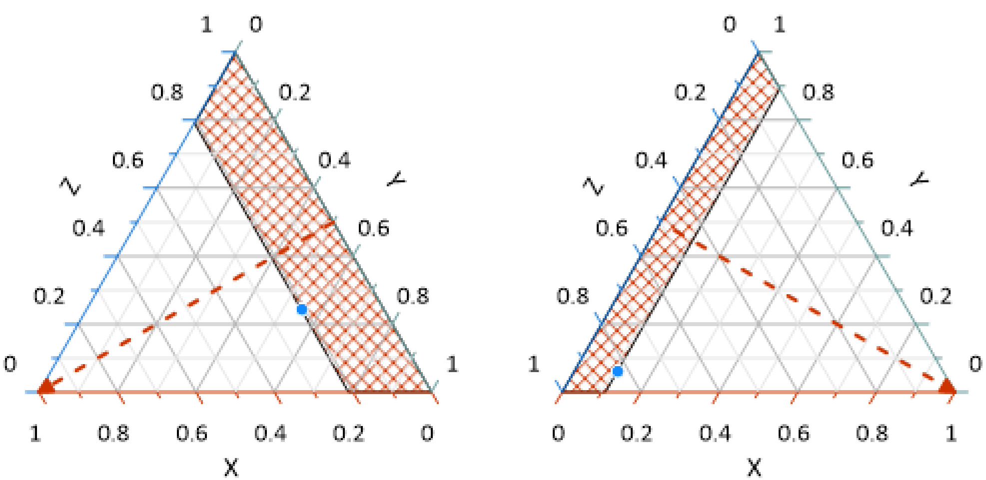
A consistent and dependable method for reading a ternary diagram includes four steps:

1. Locate the 1 (or 100%) point on the axis. The axis values increase from the base opposite this point to the 100% point.
2. Draw a line parallel to the base that is opposite the 100% point through the point you wish to read.
3. Follow the parallel line to the axis. This is the component value for that axis.
4. Repeat these steps for the remaining axes.

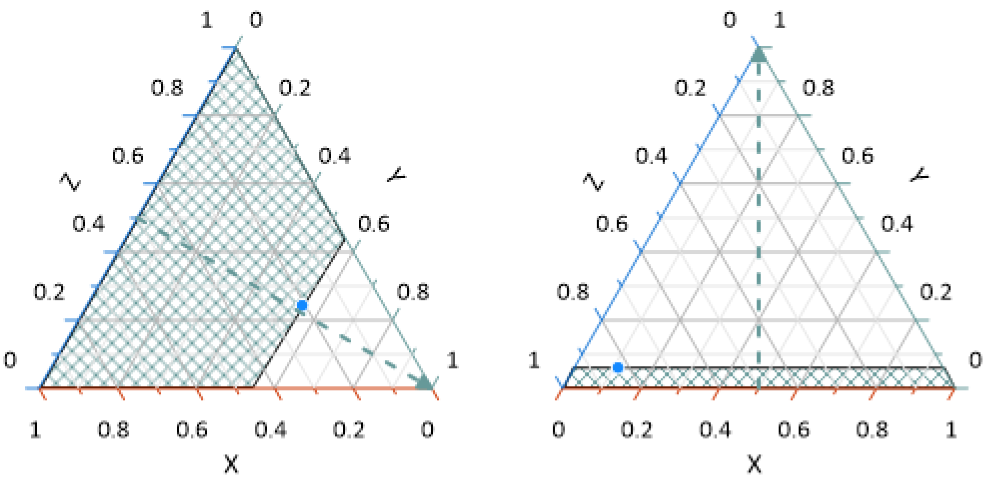
This process works regardless of the direction of the axes. For example, a piper plot includes a cation ternary plot and an anion ternary plot. The values increase in different directions in these two plots, but the principle to read them remains the same. The following example determines the X,Y,Z value for points on two different ternary plots:



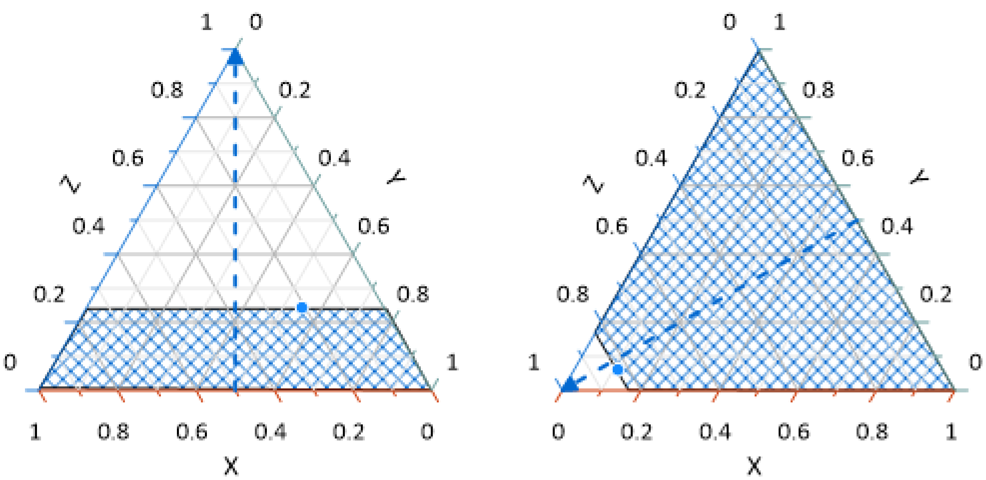
1. Determine the 100% point. This is the lower-left point on the left plot and lower-right point on the right plot.
2. Draw a line parallel to the base opposite the 100% point through the point to read.
3. Follow the parallel line to the X axis. The X value is 0.21 on the left plot and 0.11 on the right plot.



4. Repeat steps 1-3 for the Y axes. The Y value is 0.55 on the left plot and 0.06 on the right plot.



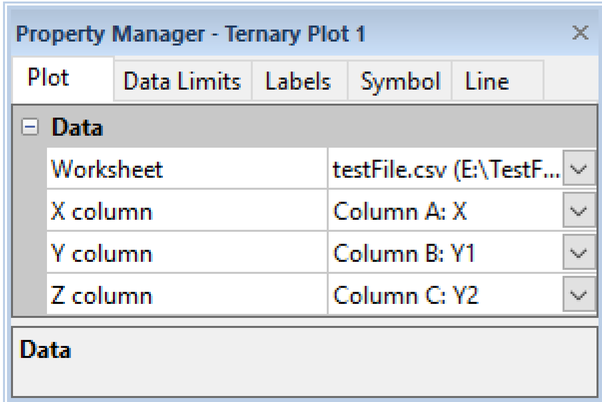
5. Repeat steps 1-3 for the Z axes. The Z value is 0.24 on the left and 0.83 on the right.



The coordinates for the point in the left ternary plot are 0.21, 0.55, 0.24. The coordinates for the point in the right ternary plot are 0.11, 0.06, 0.83. The coordinates add up to 1.00 in both cases, which is a good indication the values have been read correctly.

Plot Page - Ternary Diagrams

The ternary diagram plot properties **Plot** page contains the options to change the data file and set data used in the plot. To view and edit ternary diagram plot properties, click on the ternary diagram plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the ternary diagram plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *Y column*, and *Z column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

In ternary diagrams, the three data columns for the X, Y, and Z fields must be normalized so that their sum is 1.0 or 100, i.e., 100 percent. Data that is not normalized to 1 or 100 is automatically normalized by **Grapher** when it is plotted. For example, values of 0.50, 0.75, and 0.25 would plot as 0.33, 0.50, and 0.17, respectively.

- In the*X column*list, select the data column to plot along the X axis. 100 percent is at the lower right corner.
- In the*Y column*list, select the data column to plot along the Y axis. 100 percent is at the upper corner.
- In the *Z column* list, select the data column to plot along the Z axis. 100 percent is at the lower left corner.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

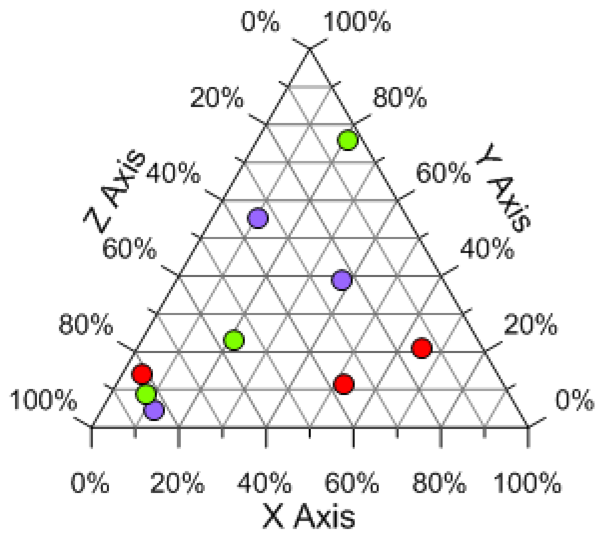
Ternary Class Scatter Plots

Click the **Home | New Graph | Ternary | Ternary Class Scatter Plot** command to represent relative percentages in a three component system. Ternary diagrams are frequently used in chemistry and earth sciences to illustrate rock classification schemes and depict chemical compositions on phase diagrams. A ternary class scatter plot is a ternary plot with symbols for each location based on a required fourth value (*Class* column). Ternary class plots group data into discrete classes (bins). The data points are displayed using the symbol assigned to the class. Ternary class plots include a legend by default. If you were analyzing the composition of a soil sample, you could use a ternary diagram to illustrate the relative percentages of three minerals found in the sample. The class could be the location, soil type name, or depth of the sample taken.

Click the **Ternary Class Scatter Plot** *button to create classed ternary diagrams.*

To plot data on a ternary class plot, the sum of the three data points (X + Y + Z) in any row must equal 100 percent. If the sum does not equal 100 percent you must normalize your data so that it meets this requirement, otherwise **Grapher** normalizes the data when it is plotted. Once this relationship has been established between the data points, you need only know the values of any two data points in order to determine the third. Reading a point on a ternary diagrams can be done by looking at the location of each point as it relates to the three axes.

You can add a line connecting the points in a ternary class plot. The line connects the data in the order it appears in the data file. To add a line, open the Line tab in the Property Manager, and then select a line style other than *Invisible*.



Ternary diagrams show percentages in a three component system.

Creating a New Ternary Class Scatter Plot

To create a ternary diagram:

1. Click the **Home | New Graph | Ternary | Ternary Class Scatter Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A ternary class plot is created using the default properties.

Editing Ternary Class Scatter Plot Properties

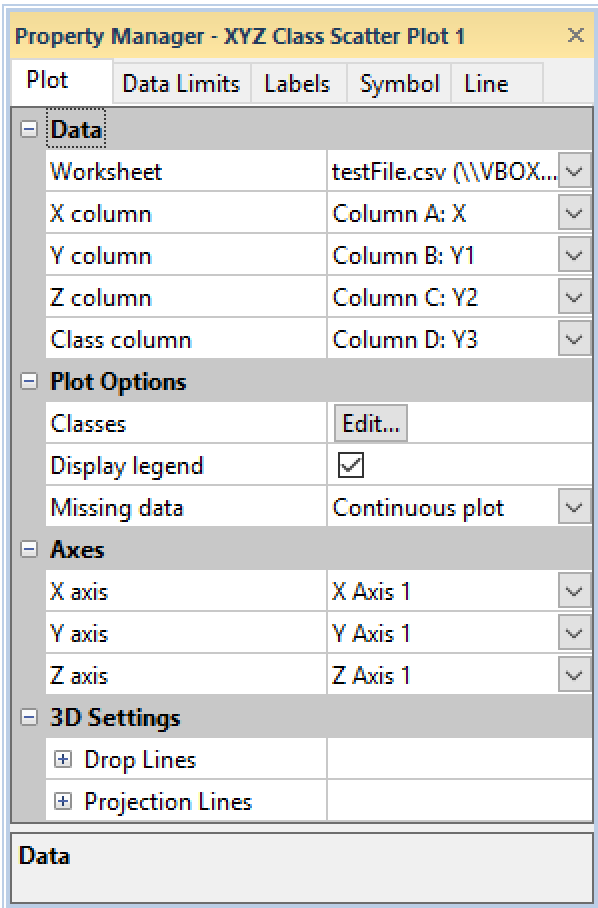
To change the features of a ternary class plot, including the columns used to create the diagram, open the ternary class plot properties by selecting the ternary class plot and editing the properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot
Data Limits
Labels
Symbol
Line

Plot Page - Class Scatter Plots

The class scatter plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; edit the classes used for the plot, and display the legend. To view and edit class scatter plot properties, click on the class scatter plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the class scatter plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column* and *Y column* or *Z column* (XYZ class scatter plot and Ternary class scatter plot only), *Radius column* (polar class scatter only), *Direction column* (polar class scatter only), and *Class column* fields. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total

number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

Note that the value in neither the *Row number* or *Sequence number* can be used in the *Class column*. The *Row number* and *Sequence number* cannot be used for any columns in a ternary class scatter plot.

When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Labels will automatically be unchecked to match the new data.

When the *Class column* includes only numeric values, a default number of classes is automatically created and all data points are displayed in one of the classes. When the *Class column* includes one or more text strings, the class*Method* is set to *Name* and the number of classes matches the number of unique text strings. Numbers are treated as text when the class method is set to *Name*.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Classes

Click the *Edit* button next to *Classes* to launch the Edit Classes dialog, which allows you to edit class information.

Display Legend

Check the box next to the *Display legend* option to make the class scatter plot legend visible. Clear the *Display legend* option to hide the legend. The legend display can also be changed in the **Object Manager** by checking or clearing the display box.

Class scatter plot legends cannot be copied and pasted. If you need to copy a class scatter plot legend, click on the legend to select it. Click the Detach Legend command to break the legend apart into multiple objects. The individual objects can be edited, but the link between the legend and the data is destroyed.

Missing Data

Rows containing text or blanks in the plotted columns are ignored and are not plotted on the graph. You can display the missing data as part of a continuous or discontinuous line using the *Missing data* options. Setting *Missing data* to *Continuous plot* connects the data line before and after the missing data. Setting *Missing data* to *Discontinuous plot* breaks the line at the missing data sections of the data set. Data filtered using the *Criteria* settings are not included as missing data. *Missing data* is not available for all plot types.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

Polar class scatter plot and ternary class scatter plot axes cannot be changed.

3D Settings

The *3D Settings* section is displayed for an XYZ class scatter plot and includes options for displaying drop lines and plot projections.

Drop Lines

3D XYZ plots have vertical, horizontal, and Z drop line options. When the box next to the *Vertical drop lines* option is checked, lines are drawn from the points to the bottom wall (XZ plane). When the box next to the *Horizontal drop lines* option is checked, lines are drawn from the point to the side wall (YZ plane). When the box next to the *Z drop lines* option is checked, lines are drawn from the point to the back wall (XY plane).

Drop Axis

When the *Vertical drop lines* or *Horizontal drop lines* box is checked, you can choose the plane to which the lines are drawn. Drop lines are drawn from the data point to the plane that intersects the drop axis minimum.

- For vertical drop lines, the XZ plane to which the drop lines are drawn is specified by the *Vert drop axis* minimum location.

- For horizontal drop lines, the YZ plane to which the drop lines are drawn is specified by the *Horz drop axis* minimum location.
- Z drop lines are always drawn to the XY plane at the Z axis maximum. There is no Z drop axis property.

Click on the current axis name next to *Vert drop axis* or *Horz drop axis*. In the list, select the desired axis. The plot is automatically updated to show the lines from the points to this axis minimum.

Drop Line Frequency

If there are many drop lines, you can change the frequency the lines are drawn by entering a new number into the *Line frequency* box. For example, if *Linefrequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped. To change the *Line frequency*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the number of drop lines in the plot.

Drop Line Properties

The drop line properties can be individually controlled with the *Vert drop line properties*, *Horz drop line properties*, and *Z drop line properties* sections on the Line page. Click the next to the appropriate section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the drop lines.

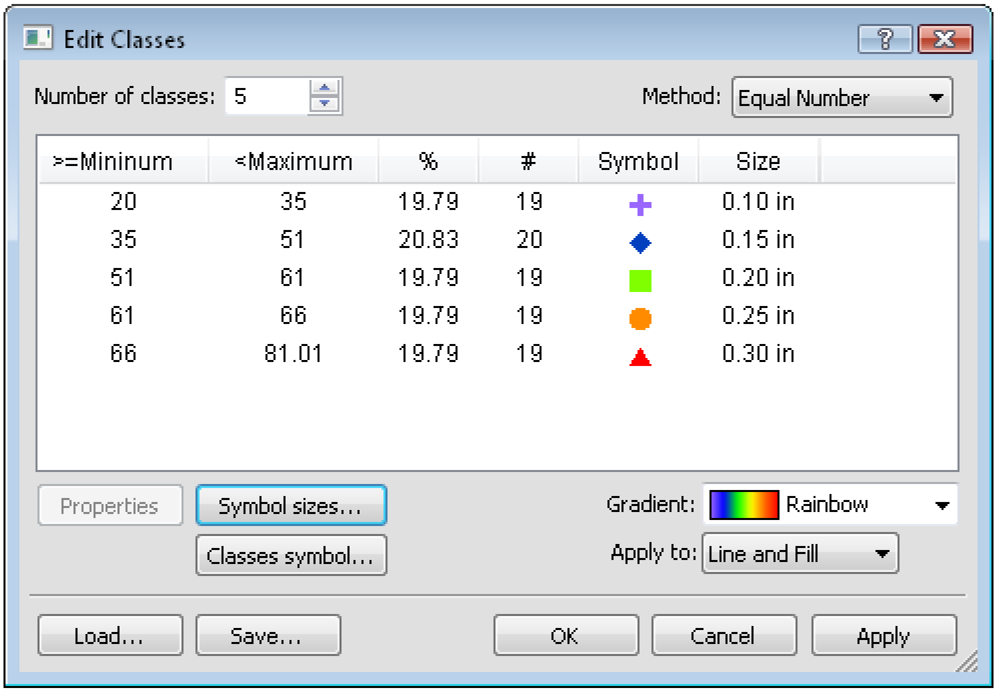
Projection Lines

Projection lines are also available for 3D XYZ plots. Projection lines are 2D representations of the 3D lines and appear on the various axis walls. Check the boxes next to the *Back projection*, *Side projection*, or *Bottom projection* options to add one, two, or all three of these projection lines to the graph. The *Back projection* option places the XY projection on the back wall of the graph. The *Side projection* option places the YZ projection on the side wall. The *Bottom* projection places the XZ projection on the bottom wall.

The projection line properties can be controlled in the *Projection line properties* section on the Line page. Click the next to the *Projection line properties* section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the projection lines.

Edit Classes Dialog

The **Edit Classes** dialog allows you to define the classes used to group the data values in a classed scatter plot. Each class is represented by a unique symbol in the class scatter plot. Click on a class scatter plot in the Object Manager or the plot window to select it. In the Property Manager, open the **Plot** page. Click the *Edit*button next to the *Classes* option to open the **Edit Classes** dialog, which allows you to edit class information.



*Use the **Edit Classes** dialog to define the classes used to group the data values.*

Number of Classes

The *Number of classes* value is used to specify how many classes or groupings should be on the plot. When you change the *Number of classes* value, the class list box is automatically updated to reflect the change. The *Number of classes* must be a whole number from 1 to 300. To change the value, highlight the existing value and type a new value or click the  to increase or decrease the value.

When the *Class column* is numeric, a default number of classes is automatically created and all data points are displayed in one of the classes. When the *Class column* is a text string, the number of classes matches the number of unique text strings in the column where an X and Y value exist.

When the *Number of classes* is increased when the *Method* is set to *Name*, a new text class is automatically added if the *Class column* has any additional text items that are not currently a *Class Name*. If there are no more unique text strings in the column, a blank class is created.

Method

The *Method* specifies the method used to calculate the limits of each class:

- *Equal Number* assigns the class ranges such that approximately an equal number of points are included in each class. In this case, the interval of each class is usually different.
- *Equal Intervals* assigns the class ranges so the interval between the *>=Minimum* value and the *<Maximum* value is equal for each class. In this case, different numbers of points are usually assigned to each class.
- *Custom* allows you to set the *>=Minimum* value and the *<Maximum* value for each class. This allows you to specify your own ranges for the classes. Ranges defined in this way do not have to be contiguous. To change the *>=Minimum* or *<Maximum* value for any class, double-click the value in the class list. In the **Properties** dialog, set the values and the symbol property. Click *OK* to return to the **Edit Classes** dialog.
- *Name* sets the method to use a text string. Each unique text string in the *Class column* is a separate *Class Name*. When the *Method* is set to Name, there is a *Class Name* option. Double-click on any text in the *Class Name* column to edit the class properties in the **Properties** dialog. The *Class Name* option can be edited to any desired text. Unique text identifiers are not case sensitive. So, One, one, and ONE are all in the same group. Numbers are treated as text when the *Method* is set to *Name*.

Class List Box

The class list box displays summary statistics and allows you to specify the properties for each class:

- The *>=Minimum* column specifies the lower limit for each class of data. You can click the *Properties* button or double-click the number for any of the classes and change the value in the **Properties** dialog. The minimum value is included in this class.
- The *<Maximum* column specifies the upper limit for each class of data. You can click the *Properties* button or double-click the number for any of the classes and change the value in the **Properties** dialog. The maximum value is not included in the class.
- The *Class Name* column specifies the individual text entries for each class of data. You can click the *Properties* button or double-click the text for any of the classes and change the text in the **Properties**

dialog. All text with the same text string are included in the class. Unique text identifiers are not case sensitive. So, *One, one,* and *ONE* are all in the same group.

- The *%* column indicates the percentage of data points in the particular class. This value cannot be edited and is for informational purposes only.
- The *#* column indicates the number of points included in each class. This value cannot be edited and is for informational purposes only.
- The *Symbol* column displays the symbol used for each class. To change a symbol or symbol property used for a particular class, click the *Properties* button or double-click the symbol and change the value in the **Properties** dialog.
- The *Size* column displays the size of the symbol used for each class. To change the size, used for a particular class, click the *Properties* button or double-click the size and change the value in the **Properties** dialog.

Symbol Sizes

Click the *Symbol sizes* button to open the Symbol Sizes dialog. The **Symbol Sizes** dialog allows the size of all classes to be changed at the same time or allows for an incremental size to be set.

Classes Symbol

Click the *Classes symbol* button to open the Properties dialog. Set the *Symbol*, *Symbol set*, *Fill*, and *Line* properties for the symbol for all classes. Click *OK* and all classes update to show the selected symbol. This is useful if the same symbol should be used, but a variable color or size should be used for all classes.

Apply Gradient

The Apply Gradient command and list applies a color gradient to the class symbol line and/or fill colors.

First, specify which properties are being colored: the line, fill, or both. Click the currently selected option next to the *Apply Gradient...* button and select the desired option from the list:

- *to line and fill* sets both the line and fill color for each symbol as determined by the gradient.
- *to line* sets only the line color by the gradient. The fill color is set by the class color.
- *to fill* sets only the fill color by the gradient. The line color is set by the class color.

Next, Click *Apply Gradient* to select the gradient in the Color Gradient dialog. Click the current selection next to *Gradient* to select a predefined gradient. Click the ... button to create a custom gradient. The *Gradient* is applied across all of the classes. The first class uses the minimum color in the gradient. The last class uses the last color in the gradient. All other classes are selected based on an equal number of intervals across the gradient.

To set the class color to something other than a gradient, double-click on the symbol in the *Symbol* column and change the color in the **Properties** dialog.

Load

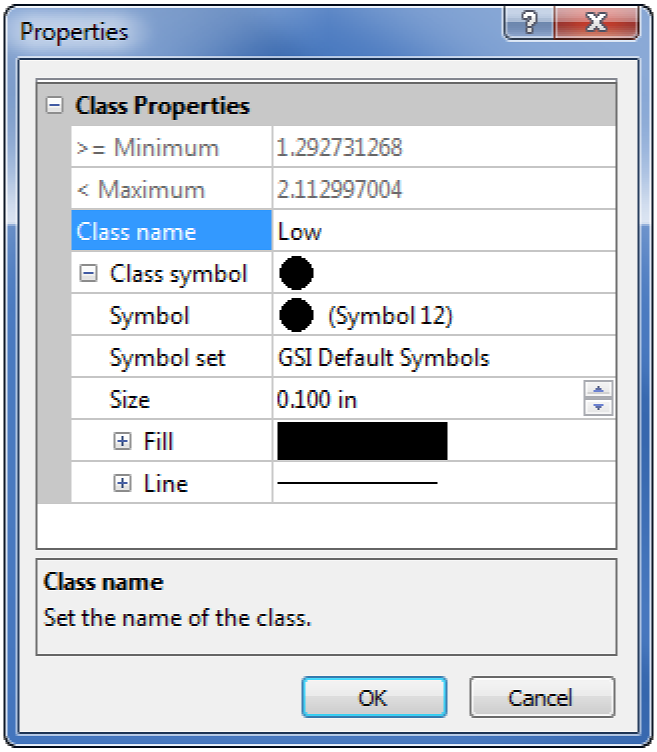
Click the *Load* button to open an existing classes .GCL file.

Save

Once all changes have been made in the **Edit Classes** dialog, click the *Save* button to save your entries as a new classes .GCL file.

Class Properties Dialog

The **Class Properties** dialog displays the properties for a class in a class scatter plot. The dialog is opened by clicking the *Properties* button in the Edit Classes dialog. The **Properties** dialog lists all of the properties for the selected class, including the *>=Minimum, <Maximum,Class name*, and *Class symbol* properties.



*The **Properties** dialog displays the properties for the selected class for a class scatter plot.*

>=Minimum

The *>=Minimum* value is the minimum value for the selected class. To change the minimum value, highlight the existing value and type a new number. Press ENTER on the keyboard to update the value. The minimum value is included in the class. This option is grayed out when the *Method* in the **Edit Classes** dialog is set to *Name*.

This option is not available when the *Classes symbol* button is clicked, as the symbol properties for all classes are set.

<Maximum

The *<Maximum* value is the maximum value for the selected class. To change the maximum value, highlight the existing value and type a new number. Press ENTER on the keyboard to update the value. The maximum value is not included in the class. This option is grayed out when the *Method* in the **Edit Classes** dialog is set to *Name*.

This option is not available when the *Classes symbol* button is clicked, as the symbol properties for all classes are set.

Class Name

The *Class name* option is grayed out when the *Method* in the **Edit Classes** dialog is set to *Equal Number, Equal Interval,* or *Custom*. The option is only available when the *Method* is set to *Name*. When available, the *Class name* displays the text associated with the text entry in the worksheet for this class. Capitalization is not important for the *Class name*. CLASS1 is the same as class1. Extra spaces or characters are important. So, class1 is not the same as class 1 or class1@. To change the text associated with any class, highlight the existing text and type the desired class text. The text displayed in the *Class name* is the same text displayed in the legend for this class.

This option is not available when the *Classes symbol* button is clicked, as the symbol properties for all classes are set.

Class Symbol

The *Class symbol* section contains the options to change the symbol properties for the selected class. The *Symbol, Symbol set, Size,* symbol *Fill* properties, and symbol *Line* properties options can be changed.

OK or Cancel

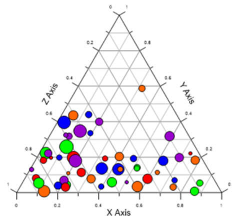
Click the *OK* button to accept the class changes. You are returned to the **Edit Classes** dialog. Click the *Cancel* button to return to the **Edit Classes** dialog without making the change.

Ternary Bubble Plots

Click the **Home | New Graph | Ternary | Ternary Bubble Plot** command to represent relative percentages in a three component system. Ternary diagrams are frequently used in chemistry and earth sciences to illustrate rock classification schemes and depict chemical compositions on phase diagrams. A ternary bubble scatter plot is a ternary plot with symbols for each location based on a required fourth value (*Size* column). Ternary bubble plots display an additional property in the plot by varying the relative size of the symbols.

*Click the **Ternary Bubble Plot** button to create the bubble plot.*

You can add a line connecting the points in a ternary bubble plot. The line connects the data in the order it appears in the data file. To add a line, open the Connecting Line tab in the Property Manager, and then select a line style other than *Invisible*.



Bubble plots show X, Y, and Z variables. The Z variable is displayed as the bubble size.

Creating a New Ternary Bubble Plot

To create a ternary bubble plot:

1. Click the **Home | New Graph | Ternary | Ternary Bubble Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A bubble plot is created using the default properties.

Editing Ternary Bubble Plot Properties

To change the features of a ternary bubble plot— including the columns used to create the plot— first select the ternary bubble plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

Labels

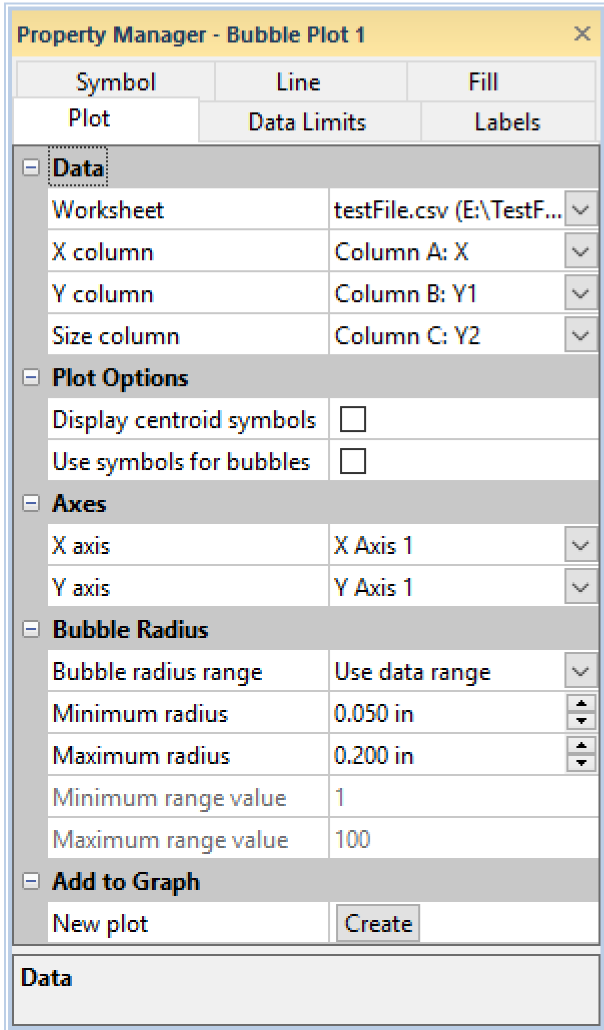
Symbol

Line

Fill

Plot Page - Bubble Plots

The bubble plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; set bubble properties; and add a new plot to the graph. To view and edit bubble plot properties, click on the bubble plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



Change the bubble plot properties in the ***Property Manager*** *on the* ***Plot*** *tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the**Open Worksheet**dialog, and click the*Open*button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *Y column*, *Z column, Size column,* and *Color column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

With 2D bubble plots, the *Z column* is used as the bubble size. In 3D XYZ bubble plots, the *Z column* is a dimension and the *Size column* controls bubble size. In ternary bubble plots, the *Size column* controls the bubble size. The *Color column*determines the color of the 3D XYZ bubbles.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

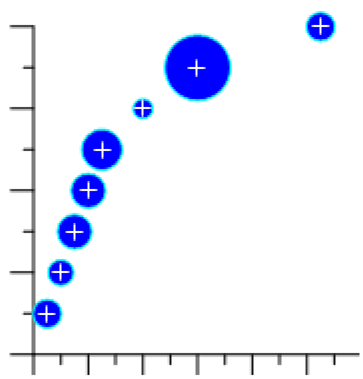
- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Bubble Centroids

The centroid location for each bubble can be displayed as a symbol on 2D bubble plots. This symbol is not scaled, and sometimes it is easier to distinguish overlapping bubbles when the centroid is visible. Check the box next to the *Display centroid symbols* to show the X, Y location of the data point as a symbol. Click the ⊞ next to *Centroid symbol* to set the centroid symbol properties.



Symbols can be displayed on the bubble's X, Y location.

Bubble Symbol

By default, the symbols in the bubble plot are open circles. The bubble line and fill color are set on the Line tab and Fill tab in the Property Manager.

Symbols other than scaled circles can be used for bubbles. To change the scaled symbol, check the box next to the *Use symbols for bubbles* option. You can change the symbol properties by clicking the ⊞ next to *Bubble symbol*.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list.

Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the [Axis - Add to Graph]() page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

Fixed Value Based Bubble Radius Range

There are two ways to define the bubble radius range, using a fixed range or using a data range. Next to the *Bubble radius range*option, select *Use fixed range* to set the radius range based on user-defined data values. Use this method when you have multiple data sets in a similar range and would like to have the same data values represented by the same bubble size with each plot.

When the *Bubble radius range* is set to *Used fixed range*, enter a *Minimum data value* and *Maximum data value*. The *Minimum data value* is assigned to the *Minimum radius* size, the *Maximum data value* is assigned to the *Maximum radius* size. Each bubble's radius is then calculated by the bubble’s data value and where it falls between the minimum and maximum data values.

To change the *Minimum data value* or *Maximum data value*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. The *Minimum data value* and *Maximum data value* are in *Z column* units for a 2D bubble plot and *Size column*units for a 3D XYZ bubble plot.

To change the *Minimum radius* or *Maximum radius* values, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the size. The *Minimum radius*and*Maximum radius*values are in page units.

Data Based Bubble Radius Range

Set the *Bubble radius range* option to *Use data range* to automatically use the data's minimum and maximum values for determining bubble size. With this method, the smallest value in the *Z column* for 2D bubble plots or the *Size column* 3D XYZ bubble plots is displayed as the *Minimum radius* value. The largest value in the *Z column* for 2D bubble plots or the *Size column* for 3D XYZ bubble plots is displayed as the *Maximum radius* value. Intermediate values are displayed proportionally between these two values.

To change the *Minimum radius* or *Maximum radius* values, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the size. The *Minimum radius* and *Maximum radius* values are in page units.

Radius Formula

The formula used for bubble size by both methods is:

Br = ((Z - Zmin)/(Zmax - Zmin)) * (Rmax - Rmin) + Rmin

where:

Br	bubble radius
Z	bubble data value
Zmin	minimum data value with *Use data range*; *Minimum data value* with *Use fixed range*
Zmax	maximum data value with *Use data range*; *Maximum data value* with *Use fixed range*
Rmin	Minimum radius
Rmax	Maximum radius

When using the *Use data range* method, the *Minimum radius* is the smallest bubble ever drawn. Similarly, the *Maximum radius* is the largest bubble ever drawn. When using the *Use fixed range* method, the bubble radii may be smaller or larger than the *Minimum radius* or *Maximum radius* sizes should any bubble’s data value be either smaller or larger than the *Minimum data value* or *Maximum data value* entries.

3D Settings

The *3D Settings* section is displayed for an XYZ bubble plot and includes options for displaying drop lines and modifying 3D bubble appearance.

Drop Lines

3D XYZ plots have vertical, horizontal, and Z drop line options. When the box next to the *Vertical drop lines* option is checked, lines are drawn from the points to the bottom wall (XZ plane). When the box next to the *Horizontal drop lines* option is checked, lines are drawn from the point to the side wall (YZ plane). When the box next to the *Z drop lines* option is checked, lines are drawn from the point to the back wall (XY plane).

Drop Axis

When the *Vertical drop lines* or *Horizontal drop lines* box is checked, you can choose the plane to which the lines are drawn. Drop lines are drawn from the data point to the plane that intersects the drop axis minimum.

- For vertical drop lines, the XZ plane to which the drop lines are drawn is specified by the *Vert drop axis* minimum location.
- For horizontal drop lines, the YZ plane to which the drop lines are drawn is specified by the *Horz drop axis* minimum location.
- Z drop lines are always drawn to the XY plane at the Z axis maximum. There is no Z drop axis property.

Click on the current axis name next to *Vert drop axis* or *Horz drop axis*. In the list, select the desired axis. The plot is automatically updated to show the lines from the points to this axis minimum.

Drop Line Frequency

If there are many drop lines, you can change the frequency the lines are drawn by entering a new number into the *Line frequency* box. For example, if *Linefrequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped. To change the *Line frequency*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the number of drop lines in the plot.

Drop Line Properties

The drop line properties can be individually controlled with the *Vert drop line properties*, *Horz drop line properties*, and *Z drop line properties* sections on the Line page. Click the next to the appropriate section to open the line properties options. The *Style, Color, Opacity,* and *Width* can be changed for the drop lines.

Draw Method and Color

There are three methods for drawing 3D bubbles. Next to the *Draw method* property, select *Wire frame 1*, *Wire frame 2*, or *Gradient fill*. To change the *Draw method*, select the current method and select the desired method from the list.

The wire frame methods draw lines on the bubbles. The line color and opacity is controlled on the Line page, and the background fill color and opacity is controlled on the Fill page. To change the *Line color* or *Fill color*, click on the existing color. In the list, select the new desired color. The *Line opacity* and *Fill opacity* control the amount of transparency for the wire frame lines and fill colors. To change the *Line opacity* or *Fill opacity*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the opacity.

The number of lines drawn on the bubbles is determined by the *Wireframe line count* property. You can draw between 10 and 100 lines on each bubble. The *Wireframe line count* field is only available when one of the wire frame methods is selected. To change the *Wireframe line count* , highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the line count.

When the *Draw method* is set to *Gradient fill*, the bubble is drawn with a color gradient across the bubble. Select or edit the color gradient *Colormap* on the Fill page. When using gradient fill, the *Gradient detail* option is also available. The *Gradient detail* determines how finely the gradient is drawn. You can set the *Gradient detail* between 10 and 1000. Lower numbers draw the gradient coarsely and higher numbers draw the gradient smoothly. The higher the value, the longer it takes to refresh the graph. To change the *Gradient detail*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the gradient detail.

Rotation

Use the *Bubble X rotation* and *Bubble Y rotation* settings to rotate the bubbles in the X and Y directions. Rotation values are in degrees. A positive rotation in the *Bubble X rotation* rotates the bottom of the bubble forward toward the screen. A positive rotation in the *Bubble Y rotation* rotates the front of the bubble clockwise.

Lighting Properties

The *Lighting* section includes the lighting properties: style, direction, color, and shininess.

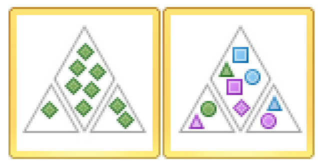
New Plot

Click the *Create* button next to the *New plot* command to create a new plot based on the current data file. A new plot is created using the same *X column* and *Y column* as the selected plot. The *Size column* changes to the next column in the worksheet that contains data. For example, if a selected bubble plot uses column A for X values, column B for Y values, and column C for size values, clicking *Create* generates a new bubble plot with column A for X values, column B for Y values, and column D for size values.

The new bubble plot is selected so you can change the new plot's properties. The line, fill, and/or symbol color automatically changes to a new color for 2D bubble plots. The *Plot palette* option on the **Options** dialog Plots page controls the colors for plots added via the *Create* button in the **Plot** page.

Piper Plot and Piper Class Scatter Plot

Click the **Home | New Graph | Ternary | Piper Plot** command to create a piper, or trilinear, diagram. Click the **Home | New Graph | Ternary | Piper Class Scatter Plot** command to create a piper diagram with classed symbols. A piper plot is one way of visualizing the chemistry of a rock, soil, or water sample. A piper diagram shows the percentages of six ion groups in two ternary plots and a diamond plot. A ternary diagram in the lower left represents the cations: calcium, sodium + potassium, and magnesium. A ternary diagram in the lower right represents the anions: chloride, carbonate + bicarbonate, and sulfate. A diamond plot is a matrix transformation of the cation and anion ternary plots.

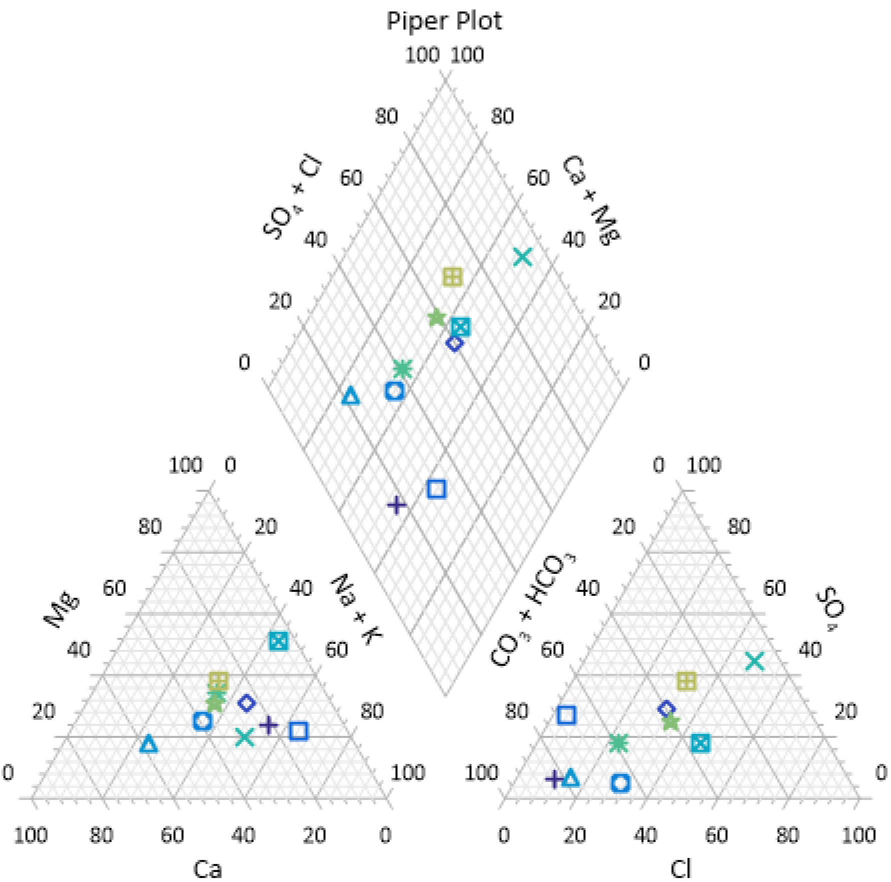


*Click the **Piper Plot** or **Piper Class Scatter Plot** button to create a piper diagram.*

To plot data on a piper diagram, the sum of the three cationic data points (X + Y + Z) and the sum of the three anionic data points must each equal 100 percent. If the sum does not equal 100 percent you should normalize your data so that it meets this requirement, otherwise **Grapher** normalizes the data when it is plotted. Once this relationship has been established between the data points, you need only know the values of any two data points in order to determine the third. Reading a point on a ternary diagrams can be done by looking at the location of each point as it relates to the three axes.

You can add a line connecting the points within each ternary diagram and in the diamond plot. The line connects the data in the order it appears in the data file. When a line is added to one of the component plots in the piper diagram, a line is added to the other plots as well. To add a line, select the *Anion* ternary plot, *Cation* ternary plot, or *Diamond* ternary plot, open the Line tab in the Property Manager, and then select a line style other than *Invisible*. A line is displayed in all three plots.

When creating a piper plot, **Grapher** assigns the data file columns in the following order: cation X, cation Y, cation Z, anion X, anion Y, anion Z, and class (if applicable). If your data is ordered differently, select the appropriate columns by selecting the *Anion* or *Cation* ternary plot and specifying columns in the **Property Manager**Plot page.



Piper plots show the ionic concentrations in water, soil, or rock chemical samples.

Creating a New Piper Plot

The following steps demonstrate how to create a piper diagram:

1. Click the **Home | New Graph | Ternary | Piper Plot** or **Home | New Graph | Ternary | Piper Class Scatter Plot** command.
2. Select the data file in the Open Worksheet dialog. Select a new data file, or select a file that is already open in the *Open worksheets* section of the dialog.
3. Click *Open* to create the piper plot.

Editing Piper Plot Properties

To change the features of a piper diagram, including the columns used to create the diagram, open properties by selecting the anion ternary plot, cation ternary plot, or diamond plot and editing the properties in the Property Manager.

Label properties are edited independently for the anion, cation, and diamond plots in the piper diagram. However, label properties can be applied to the piper diagram components at the same time by selecting the anion, cation, and diamond plots and editing the similar properties in the **Property Manager**.

The *Worksheet*, *Class column*, data limits, symbol, and line properties are shared between the cation, anion, and diamond plots. The property is changed for all plots when the property is changed for any one plot.

The separation distance between the anion, cation, and diamond plots is specified on the Graph page.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

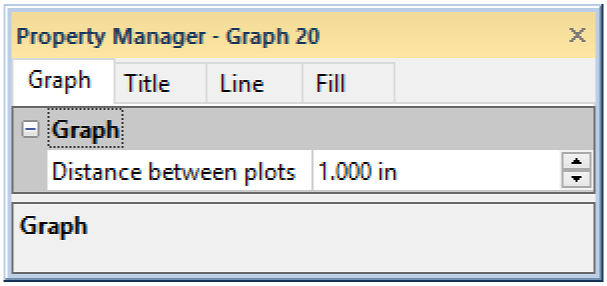
Labels

Symbol

Line

Graph Page - Piper Plots

The **Graph** page of the Property Manager sets the overall graph properties for the piper diagram. The **Graph** page includes the property for setting the distance between the diamond and ternary plots in the piper diagram. To edit the graph properties, select the *Graph* object in the Object Manager.



*Set the spacing between plots in the **Graph** page.*

Distance Between Plots

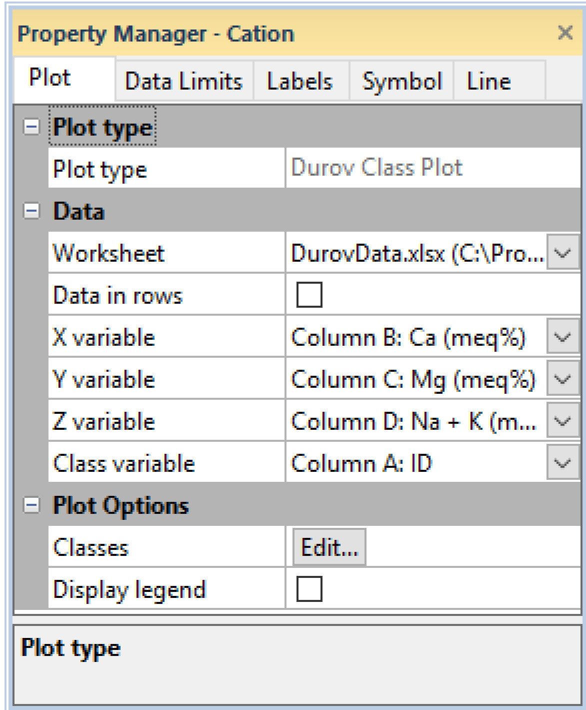
The *Distance between plots* property specifies the distance between the cation ternary plot Y axis and the diamond plot Y2 Na + K axis. This is the same distance as that between the anion ternary plot Z axis and the diamond plot Z2 CO_3 + HCO_3 axis. Specify the separation distance by typing a value between 0.100 and 100.000 inches (0.254 and 254.000 centimeters) in the *Distance between plots* field. Alternatively, click the button to increase or decrease the *Distance between plots* value.

Axes Length

The *Axes length* property set the length for the Piper plot axes. The *Axes length* property specifies the length of all axes in the Piper plot. It is also possible to change the Piper plot size by clicking and dragging a selection handle or typing a value in the Size ribbon field.

Plot Page - Piper Diagrams and Durov Plots

The piper and Durov diagram plot properties **Plot** page contains the options to change the data file and set data used in the anion and cation ternary plots. The piper diagram *Diamond* plot and the Durov plot *Square* plot do not have a **Plot** page. The **Plot** page also includes the classes for the piper and Durov class diagram. To view and edit properties, click on the anion ternary plot, cation ternary plot, diamond plot, square plot, pH plot, or TDS plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



Set the X, Y, and Z data columns as well as class properties in the ***Plot*** *page.*

Plot Type

The *Plot type* property displays the type of plot.

Data

The *Data* section includes the data file and column specifications for the *Cation* and *Anion* plots in the piper and piper class diagram. The *Diamond* plot does not include the *Data* section, as the diamond plot points are defined by the cation and anion ternary diagram data.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *Y column*, and *Z column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

In ternary diagrams, the three data columns for the X, Y, and Z fields must be normalized so that their sum is 1.0 or 100, i.e., 100 percent. Data that is not normalized to 1 or 100 is automatically normalized by **Grapher** when it is plotted. For example, values of 0.50, 0.75, and 0.25 would plot as 0.33, 0.50, and 0.17, respectively.

- In the *X column* list, select the data column to plot along the X axis. 100 percent is at the lower right corner.
- In the *Y column* list, select the data column to plot along the Y axis. 100 percent is at the upper corner.
- In the *Z column* list, select the data column to plot along the Z axis. 100 percent is at the lower left corner.
- In the *Class column* list, select the data column to classify the points. Numeric data can be used to classify the points by value. Text data can be used to classify the points by name, for example by sample location. You may need to convert numbers to text to use numeric values as a named class.

When the *Class column* includes only numeric values, a default number of classes is automatically created and all data points are displayed in one of the classes. When the *Class column* includes one or more text strings, the *Class method* is set to *Name* and the number of classes matches the number of unique text strings.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click

on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Plot Options

The piper class diagram includes a *Plot Options* section in the **Plot** page. The *Plot Options* properties control the classes and display of the class legend. The *Plot Options* section is displayed for the *Cation*, *Anion*, and *Diamond* plots.

Classes

Click the *Edit* button next to *Classes* to launch the Edit Classes dialog, which allows you to edit class information.

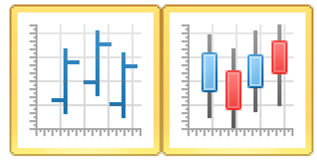
Display Legend

Check the box next to the *Display legend* option to make the class plot legend visible. Remove the check mark to hide the legend. The legend display can also be changed in the **Object Manager** by checking or unchecking the display box.

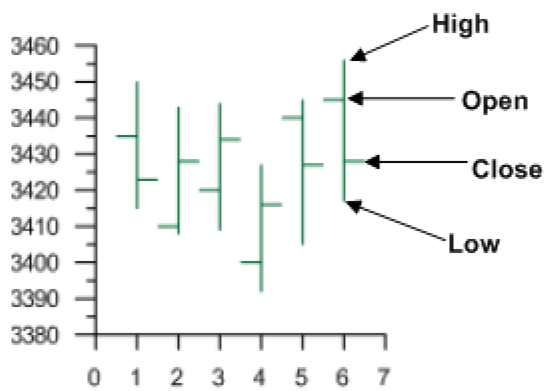
Class plot legends cannot be copied and pasted. If a class plot legend should be copied, click on the legend to select it. Click the Graph Tools | Plot Tools | Detach Legend command to break the legend apart into multiple objects. The individual objects can be edited.

High-Low-Close Plots

Click the **Home | New Graph | Specialty | High-Low-Close Plot** or **Home | New Graph | Specialty | High-Low-Close Candlestick Plot** command to display a range of Y values at each X value. This plot is commonly used to display the daily high, low, opening, and closing stock values, although it can be used for other data types. A vertical line is drawn between the high and low values, and horizontal lines show the opening and closing values. The opening value is a horizontal line to the left of the hi-low vertical line, and the closing value is a horizontal line to the right of the hi-low vertical line. Opening and closing values are optional. The high values must be greater than the low values. Hi-low-close plots may also be drawn as "candlestick" plots where a box is drawn between the opening and closing values.



Click the **High-Low-Close Plot** *or* **High-Low-Close Candlestick Plot** *buttons to create high-low-close plots.*



Hi-low-close plots show four variables, typically stock values.

Creating a New High-Low-Close Plot

To create a high-low-close plot:

1. Click the **Home | New Graph | High-Low-Close Plot** or **Home | New Graph | High-Low-Close Candlestick Plot** command
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.

3. Click the *Open* button. A high-low-close plot or high-low-close candlestick plot is created using the default properties.

Editing High-Low-Close Plot Properties

To change the features of a high-low-close plot— including the columns used to create the graph— first select the high-low-close plot in the plot window or Object Managerand then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

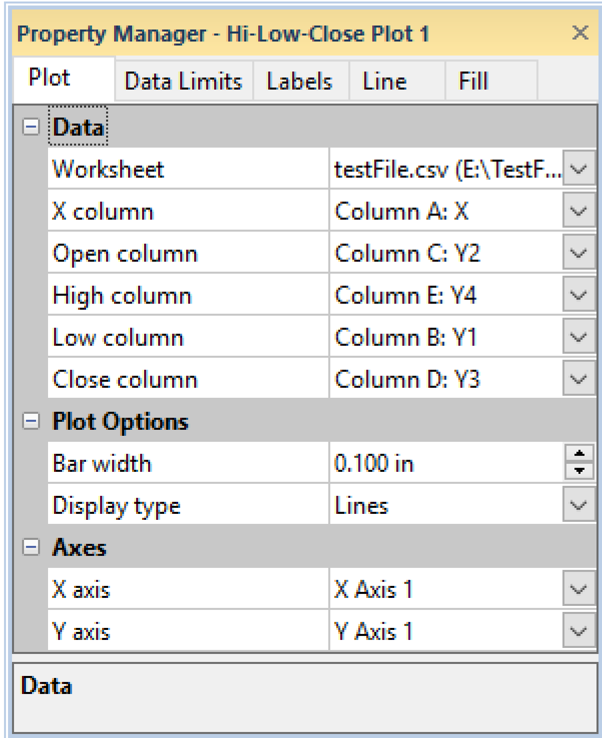
Labels

Line

Fill

Plot Page - High-Low-Close Plots

The high-low-close plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; set the bar width; and set the display type. To view and high-low-close plot properties, click on the high-low-close plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the line/scatter plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *High column*, *Low column, Open column,* and *Close column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

The *X column* is normally the date for high-low-close plots. This is the column that contains the X axis location for each bar. The *High column* is the column that contains the largest value for each row. The *High column* contains values greater than the numbers in the *Low column*. The *Low column* is the column that contains the smallest value for each row. The *High column* and *Low column* are required. The *Open column* displays as a tick mark on the left side of the vertical bar. The *Close column* displays as a tick mark on the right side of the vertical bar. If there are no open or close values, choose *None* for the *Open column* and *Close column* settings.

Aside from the columns containing data there are two other options for the *X column*: row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

When changing the *X column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the *X column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

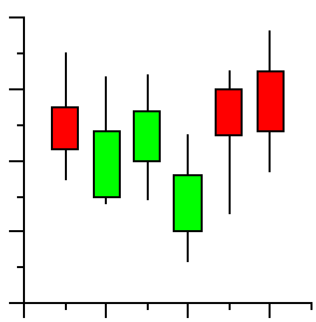
NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Bar Width

Set the width of the open and close tick marks in the *Bar width* option. Open tick marks are plotted to the left of the horizontal high-low line. Close tick marks are plotted to the right of the horizontal high-low line. To set the *Bar width*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the bar width value. The *Bar width* is a value in page units between 0.0 and 5.0 inches (0.0 and 12.7 centimeters).

Display Type

High-low-close plots can be displayed as lines or as "candlesticks." When selecting *Lines*, the plot appears as a vertical line between the high and low value with tick marks for the open and close values. When *Candlestick* is the selected *Display type*, the plot appears as a line between the high and low value with a box between the opening and closing lines. You must select data for the *Open column* and *Close column* if you wish to display the high-low-close plot as candlesticks. To change the *Display type*, click on the existing option. Select the desired option from the list.



high-low close plots can be displayed as a candlestick plot. The box color depends on whether the closing value is greater or less than the opening value.

Candlestick Fill

You can choose fill options for the boxes when the *Display type* is set to *Candlestick.* The fill properties are located on the [Fill] page. The *Up fill style* is the fill style for when the closing value is greater than the opening value. This color indicates that the stocks gained this day. The *Down fill style* is the fill style for when the closing value is less than the opening value. This color indicates that the stocks lost value this day. Click the ⊞ next to *Up fill style* or *Down fill style* to open the fill properties for each.

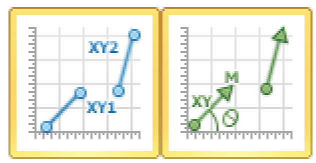
Change Axes

Click on the axis name next to the *X axis*or*Y axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*or*Y axis* lists.

Vector Plots

Click the **Home | New Graph | Specialty | 2-Point Vector Plot** or **Home | New Graph | Specialty | 1-Point Vector Plot** command to create a 2D vector plot.

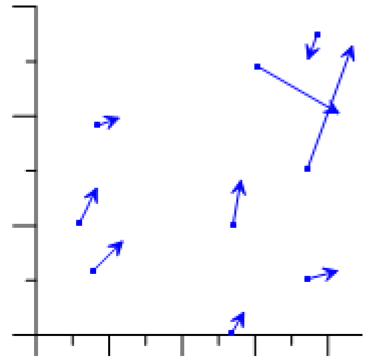


Click the **2-Point Vector Plot** *or* **1-Point Vector Plot** *button to create a vector plot.*

Vector plots create vector lines between two points or from one point to the specified angle direction and with the selected magnitude.

2-Point Vector Plots are created from four data columns. Two columns specify the starting X and Y location. Two other columns specify the ending X and Y location. A straight line with a vector arrow is drawn between the two points.

1-Point Vector Plots are also created from four data columns. Two columns specify the starting X and Y location. Two other columns specify the direction and magnitude of the vector. A straight line is drawn from the starting X and Y location in the direction specified with a length of the magnitude. The direction column is specified in degrees and increases in the clockwise direction, where 0 or 360 degrees is Up (North), 90 degrees is Right (East), 180 degrees is Down (South), and 270 degrees is Left (West).



Vector plots show data as straight-line segments.

Creating a New Vector Plot

To create a vector plot:

1. Click the **Home | New Graph | Specialty | 2-Point Vector Plot** or **Home | New Graph | Specialty | 1-Point Vector Plot** command.
2. Select a worksheet file in the **Open Worksheet** dialog. You can select a new data file or you can select an open worksheet file in the *Open worksheets* section.
3. Click the *Open* button. A vector plot is created using the default properties.

Editing Vector Plot Properties

To change the features of the vector plot— including the columns used to create the plot— first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

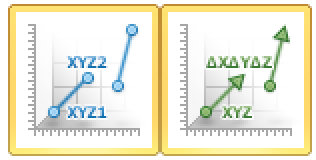
Labels

Symbol

Line

XYZ Vector Plots

Click the **Home | New Graph | Specialty | XYZ 2-Point Vector Plot** or **Home | New Graph | Specialty | XYZ-dx,dy,dz Vector Plot** command to create an XYZ vector plot.



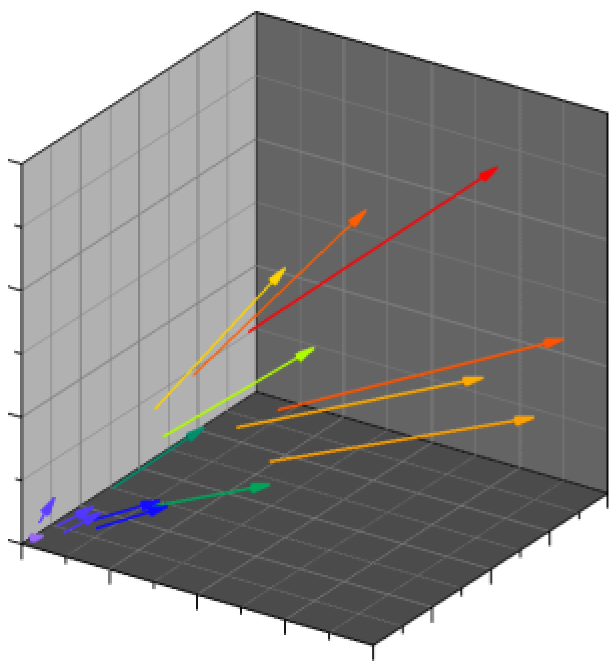
*Click the **XYZ 2-Point Vector Plot** or **XYZ-dx,dy,dz Vector Plot** button to create a vector plot.*

Vector plots create vector lines between two points or from one point to the X+dx, Y+dy, and Z+dz values.

When symbols are displayed on 3D vector plots, symbols are shown at the beginning of the vector line. When arrows are displayed on a 3D vector plot, the arrows are shown at the end of the vector line.

XYZ 2-Point Vector Plots are created from six data columns. Three columns specify the starting X, Y, and Z location. Three other columns specify the ending X, Y, and Z location. A straight line with a vector arrow is drawn between the two points.

XYZ-dx,dy,dz Vector Plots are also created from six data columns. Three columns specify the starting X, Y, and Z location. Three other columns specify the magnitude in the X, Y, and Z direction (dx, dy, and dz) for the vector. A straight line is drawn from the starting X, Y, Z location to the X+dx, Y+dy, Z+dz location.



Vector plots show data as straight-line segments.

Creating a New XYZ Vector Plot

To create an XYZ vector plot:

1. Click the **Home | New Graph | Specialty | XYZ 2-Point Vector Plot** or **Home | New Graph | Specialty | XYZ-dx,dy,dz Vector Plot** command.
2. Select a worksheet file in the **Open Worksheet** dialog. You can select a new data file or you can select an open worksheet file in the *Open worksheets* section.
3. Click the *Open* button. A 3D vector plot is created using the default properties.

Editing 3D Vector Plot Properties

To change the features of the vector plot— including the columns used to create the plot— first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

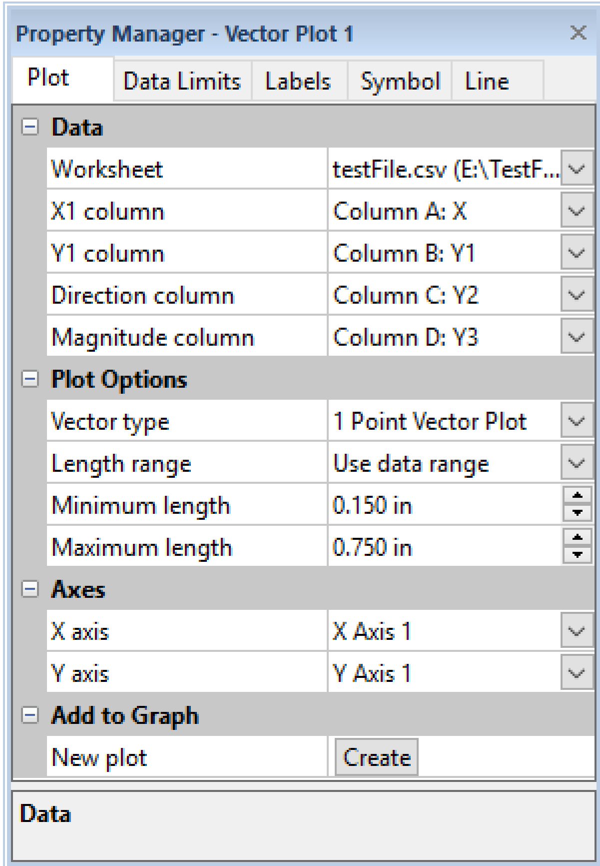
Labels

Symbol

Line

Plot Page - Vector Plots

The vector plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; set vector properties; and add a new plot to the graph. To view and edit vector plot properties, click on the vector plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



Change the line/scatter plot properties in the ***Property Manager*** *on the* ***Plot*** *tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *Y column*, *X1 column, Y1 column, Z1 column, X2 column, Y2 column, Z2 column*, *Direction column, Magnitude column, DX column, DY column,* or *DZ column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

When changing the *X column, Y column, X1 column, Y1 column, Z1 column, X2 column, Y2 column, Z2 column, Angle column, Magnitude column, DX column, DY column, or DZ column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the columns to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click

on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Vector Type

Click the *Vector type* field to choose the format in which to display the vector data.

For a 2D vector plot, the choices are *1-Point Vector Plot* and *2-Point Vector Plot.* The *1-Point Vector Plot* option contains a starting XY position and angle direction and magnitude values. The vectors are drawn from the XY position to the point determined by the direction and magnitude values. The *2-Point Vector Plot* option contains two XY positions that are connected by a vector.

For an XYZ vector plot, the choices are *2-Point Vector Plot* and *XYZ-dx,dy,dz.* The *2-Point Vector Plot* option contains two XYZ positions that are connected by a vector. The XYZ-dx,dy,dz option contains a starting XYZ position and distances in each of the X, Y, and Z directions for the vector. The vectors are drawn from the XYZ position to the point determined by the dx, dy, dz values.

Length Range

When the *Vector type*is set to*1 Point Vector Plot*, the*Length range*option becomes available. Click the *Length range* field to choose between *Use data range* (plot data) and *Use fixed range* (assigned setting) for the minimum and maximum length. To change the *Length range*, click on the existing option and select the new option from the list.

Minimum and Maximum Lengths

The *Minimum length* and *Maximum length* fields are the smallest and largest vectors defined when the *Use data range* is selected for the *Length range* option. When the *Length range* option is set to *Use fixed range*, the *Minimum length* and *Maximum length* are the defined lengths for the *Minimum data value* and *Maximum data value*. To change either the *Minimum length* or *Maximum length*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the value. The *Minimum length*and*Maximum length*are in page units.

Minimum and Maximum Data Values

When the *Length range*is set to*Use fixed range,*the*Minimum data value*and*Maximum data value*options become available. Click the *Minimum data value*and*Maximum data value*fields to set the data values for the minimum and maximum lengths. These values are in the*Magnitude* *column*units. To change the*Minimum data value*or*Maximum data value*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

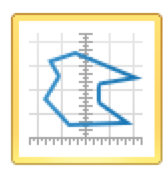
See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

New Plot

Click the *Create* button next to the *New plot* command to create a new plot based on the current data file. The *Create* button is not available for an XYZ vector plot. A new plot is created using the same *X1 column* and *Y1* column as the selected plot. The *X2 column* and *Y2 column*, or *Direction column* and *Magnitude column*, change to the next columns in the worksheet that contain data. For example, if a selected vector plot uses columns A and B for the *X1 column* and *Y1 column* and columns C and D for the *X2 column* and *Y2 column*, clicking *Create* generates a new vector plot with columns A and B for the *X1 column* and *Y1 column* and columns E and F for the *X2 column* and *Y2 column*. The new vector plot is selected so you can change the new plot's properties.

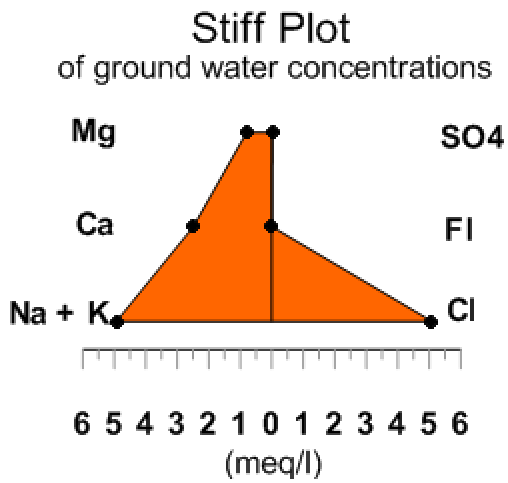
Stiff Plot

Click the **Home | New Graph | Specialty | Stiff Plot** command to create a stiff plot. A stiff plot is used by hydrologists to compare the ionic composition of water samples between different locations, depths, or aquifers. The values of the cations and anions are plotted in milliequivalents per liter. The left side of the diagram shows the cation concentrations and the right side shows the anion concentrations. The farther a point is from the center, the larger the ionic concentration. The individual ionic points are connected to create the "stiff plot." The relative size of the stiff plot is an indication of the total dissolved solids concentration.



Click the Stiff Plot button to create a stiff plot.

Normally, a stiff plot is not viewed individually, but in a group. Relative relationships among multiple stiff plots are then compared in order to draw an overall opinion about an aquifer or location. Cations and anions need to be in separate columns. When you create the stiff plot, specify which column has the cations and which has the anions. You can model as many different cations and anions as needed. Each column can use a different number of rows.



A stiff plot contains cation and anion values to allow for comparison of the ionic composition of water samples.

Creating a New Stiff Plot

To create a stiff plot:

1. Click the **Home | New Graph | Specialty | Stiff Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A stiff plot is created using the default properties.

Editing Stiff Plot Properties

To change the features of a stiff plot— including the columns used to create the plot— first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

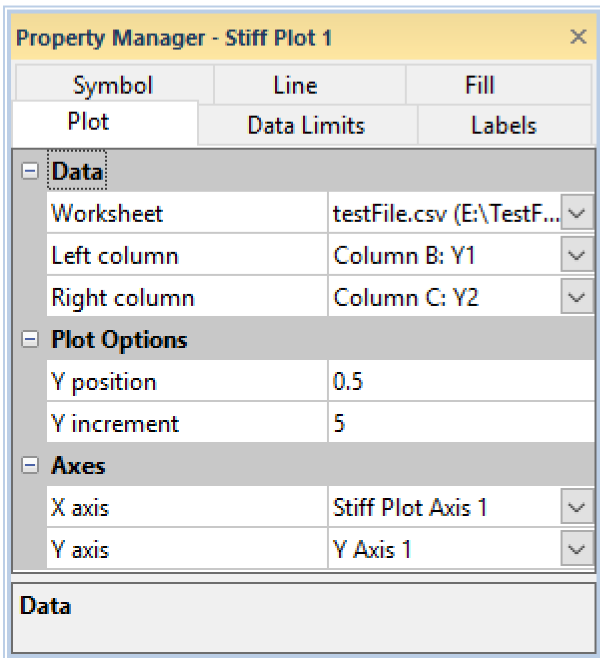
Click the following tabs in the **Property Manager** to change different properties:

Plot
Data Limits
Labels
Symbol

[Line](#)
[Fill](#)

Plot Page - Stiff Plots

The stiff plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; and set the plot position. To view and edit stiff plot properties, click on the stiff plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the stiff plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *Left column* or *Right column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter. The *Left column* is traditionally the column that contains the cation concentrations. The *Right column* is the column that contains the anion concentrations.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Y Position

The *Y position* sets the Y axis value at which the plot begins. Note that if you have only a single stiff plot created on your graph, you may not notice a change in *Y position*, as the axis uses automatic spacing. This feature is more noticeable when multiple stiff plots are added to the same graph, as each stiff plot can then have a different*Y position*to prevent overlap between stiff plots. The*Y position*value is in Y axis coordinates. To change the*Y position*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change.

Y Increment

The *Y increment* is the increment by which the data should be spaced on the Y axis. As with the *Y position*, a change in *Y increment* is noticeable only when there are multiple stiff plots on a single graph. The *Y increment* can also be used to prevent overlap between stiff plots on the same graph. The *Y increment* value is in Y axis coordinates. To change the *Y increment*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change.

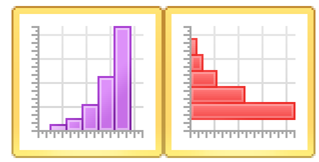
Change Axes

Click on the axis name next to the *X axis*or*Y axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

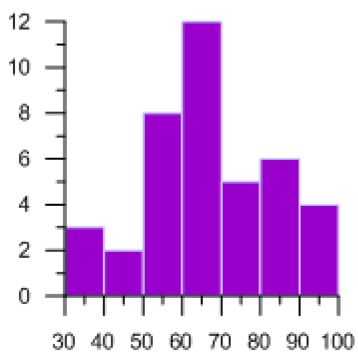
See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*or*Y axis* lists.

Histogram Plots

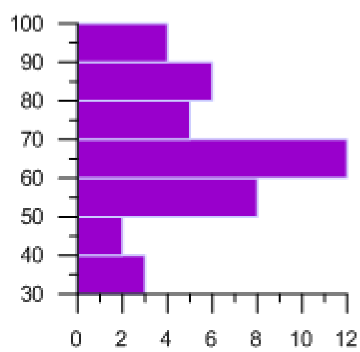
Click the **Home | New Graph | Statistical | Vertical Histogram** or **Home | New Graph | Statistical | Horizontal Histogram** command to display data in groups or bins. Each bin represents a range of values on the X axis. The height of a bin represents the number of data points that fall within that bin's range. If there is one Y value for each X value in the data set, use the bar chart rather than the histogram. Histograms can be oriented vertically or horizontally. The histogram discussion assumes a vertical orientation.



Click the **Vertical Histogram** *or* **Horizontal Histogram** *buttons to create histogram plots.*



Vertical histograms display data in a series of groups called bins.



Horizontal histograms display data in a series of groups called bins.

Creating a New Histogram

To create a histogram:

1. Click the **Home | New Graph | Statistical | Vertical Histogram** or **Home | New Graph | Statistical | Horizontal Histogram** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A histogram is created using the default properties.

Editing Histogram Properties

To change the features of a histogram— including the bins used to create the histogram— first select the histogram in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

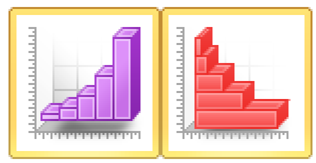
Labels

Line

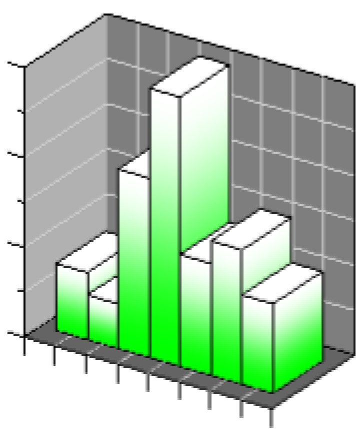
Fill

3D Histogram Plots

Click the **Home | New Graph | Statistical | 3D Vertical Histogram** or **Home | New Graph | Statistical | 3D Horizontal Histogram** command to display data in groups or bins. Each 3D bin represents a range of values on the X axis. The height of a bin represents the number of data points that fall within that bin's range. If there is one Y value for each X value in the data set, use the bar chart rather than the histogram.



*Click the **3D Vertical Histogram** or **3D Horizontal Histogram** buttons to create 3D histograms.*



This is an example of a 3D histogram.

Creating a New 3D Histogram

To create a 3D histogram:

1. Click the **Home | New Graph | Statistical | 3D Vertical Histogram** or **Home | New Graph | Statistical | 3D Horizontal Histogram** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A 3D histogram is created using the default properties.

Editing 3D Histogram Properties

To change the features of a 3D histogram— including the bins used to create the histogram— first select the histogram in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

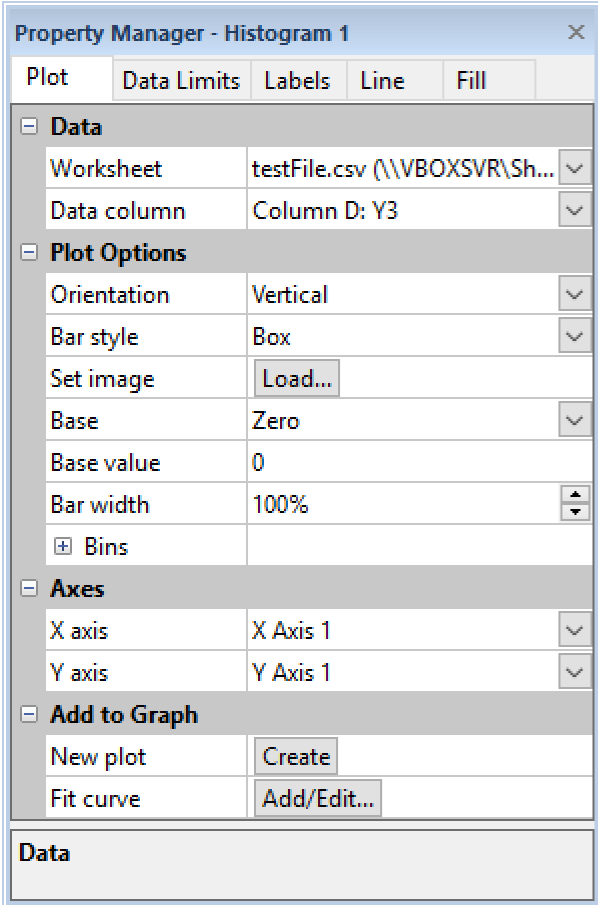
Labels

Line

Fill

Plot Page - Histogram Plots

The histogram plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; add a fit curve to the graph; and set bar properties. To view and edit histogram plot properties, click on the histogram plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*The histogram properties are edited in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *Data column* field to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options, row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Orientation

Histograms can be displayed horizontally or vertically. The *Orientation* options let you change the orientation of the bars. The default setting is *Vertical*, which plots the height of the bars vertically. The *Horizontal* option rotates the bars by 90°, showing the height of the bars horizontally. This results in a histogram where the bars protrude horizontally from the vertical axis.

Bar Style

The *Bar style* option allows the histogram bars to be drawn as rectangles or as another shape. To change the *Bar style*, click on the existing option. In the list, select a new option. The options available are *Box, Cone, Inverted cone, Diamond, Spindle,* and *Image*. The bar chart automatically updates to the new style.

If the *Bar style* is set to *Image*, the *Set image* command becomes available. Click the *Load* button next to *Set image* to open the Set Image dialog. Select the image and click *OK* to display the image on the bar chart.

Base

The *Base* and *Base value* indicate the location on the plot where the histogram bars originate. The graph varies depending on the selected *Base value*. The *Base* of the bars can be set to the data minimum, to the data maximum, to zero, or to a custom value. The bars are drawn from the base value to the data point value. To change the *Base value*, click on the existing option next to the *Base*. Select a new option from the list. Setting the *Base* to *Zero* causes all bars to originate at the zero axis value. Positive data values are drawn upward and negative data values are drawn downward. The *Data minimum* option draws all bars from the data minimum to the data value. The *Data maximum* option draws all bars from the data maximum to the data value.

The *Custom* option draws all bars from the *Base value* to the data value. The bars are drawn upward or downward depending on the data values and the custom base number.

To set the *Base value*, highlight the existing value and type a new value into the box. Press ENTER on the keyboard to make the change.

For example, if the *Base* is set to *Zero* and the Y data value is 1500, the bar is drawn from zero to 1500 on the Y axis. If the *Base* is set to *Custom* and the *Base value* is set to 5000, the bar is drawn from 5000 to 1500.

Bar Width

The *Bar width* field controls the width of the histogram bars. Set the width of the bars from 1 to 50000 percent. The default width is 100 percent. The 100 percent width is determined by the range of the X values. When the *Barwidth* is set to 100 percent, the bars touch and cover 100 percent of the data range. When the *Bar width* is set to 50 percent, the bars cover 50 percent of the data range and there are gaps between the bars. When the width is set to a value greater than 100 percent the bars overlap. To change the bar width value, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Slices

In a 3D histogram, when the *Bar style* is set to an option other than *Box*, the *Slices* option becomes available. The *Slices* option controls the number of sides that the 3D shape has. With a *Bar style* set to *Cylinder*, the more *Slices* the object contains, the closer to a round cylinder the object will be displayed. The *Slices* option can be set to a whole number between 2 and 100. When the *Slices* is set to 2, the object appears as two dimensional.

The line properties for the slice lines are set on the Line tab.

Stacks

In a 3D histogram, when the *Bar style* is set to an option other than *Box*, the *Stacks* option becomes available. The *Stacks* option controls the number horizontally stacked sections that the 3D shape has. The *Stacks* option can be set to a whole number between 2 and 100.

The line properties for the stack lines are set on the Line tab.

Bins

The *Bins* section controls how the values in the *Data column* are grouped. This controls the height of the bars, because different binning properties will result in different bars. To open the *Bins* section, click on the next to *Bins*. Data values are placed in bins where the value is greater than the bin minimum and less than or equal to the bin maximum, i.e. bin minimum < x <= bin maximum.

Minimum Bin

The *Minimum bin* controls the beginning X value for the first bin. To change the *Minimum bin*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. To return the value to the automatically selected *Minimum bin* value, click the word *Custom* next to the value. *Custom* will automatically change to *Auto* and update the *Minimum bin* with the automatic value.

Grapher calculates the *Minimum bin* by subtracting the *Bin size* from the smallest data value. This way, only the minimum data value is always included in the first bin. Setting the *Minimum bin* value equal to the smallest data value will exclude the data from the histogram, since values that equal bin minimums are not included in the bin.

Number of Bins

The *Number of bins* is the number of bars displayed on the graph. To change the *Number of bins*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the  to increase or decrease the number of bins.

Bin Size

The *Bin size* controls the range of X values contained in each bar in the histogram. To change the *Bin size*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change.

The first bin includes values greater than the *Minimum bin* value. Each additional bin begins at slightly greater than the next bin value, which is calculated by adding the *Minimum bin* and the *Bin size*. All bins include the maximum value for that bin.

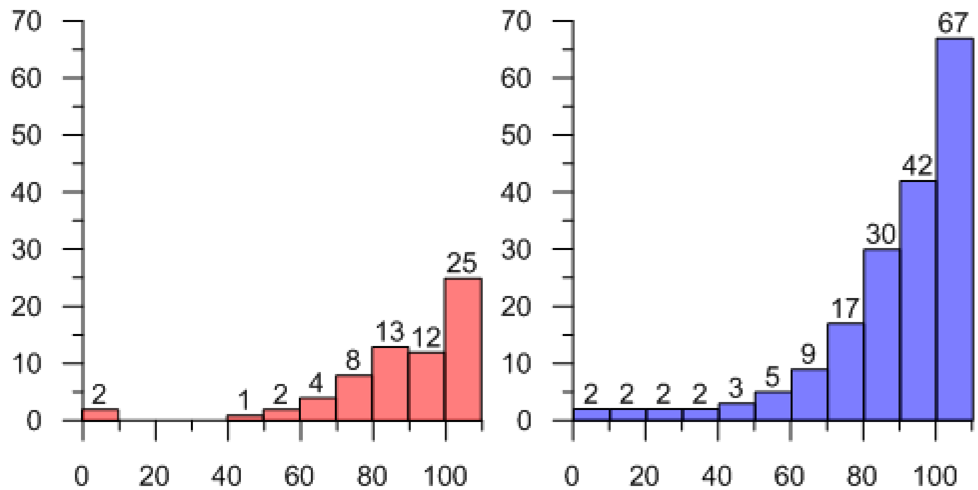
For example, if the *Minimum bin*is 0 and the*Bin size*is 10, the first bin includes the values greater than (but not equal to) 0 and less than or equal to 10. The next bin would include any values greater than 10 and less than or equal to 20. The third bin would include any values greater than 20 and less than or equal to 30.

Relative Frequency

To display data values as relative frequency rather than the total number of observations in a bin, check the box next to the *Display as relative frequency* command. When this box is not checked, bars display the total number of counts from the *Data column* in each bin.

Cumulative Histogram

To display the histogram as a cumulative histogram, check the box next to *Display as cumulative plot*. When checked, the value for each histogram bin is the sum of the values in the bin and all previous bins. When unchecked, each bin is summed separately.



The histogram on the left shows the default histogram. Each bin is separate.

The histogram on the right shows the cumulative histogram. Each bin value is the sum of the values in the bin and all previous bins.

Reset Bins

Click the *Reset* button next to the *Reset bins* option to reset the automatic bins to the original default values. This changes the *Minimum bin, Number of bins,* and *Bin size* to the default values. This will cover all of the data in the *Data column*.

Bins Type

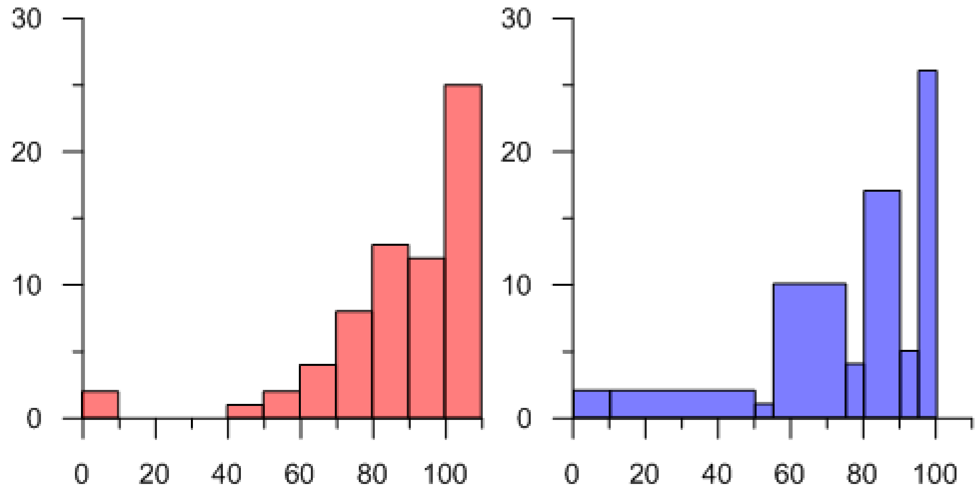
Histogram bins can be automatic or custom. Automatic bins use the values in the *Minimum bin*, *Number of bins*, and *Bin size* options to determine the starting bin value, how many bar are displayed, and the bin size of each bar. To change the *Bins type*, click on the existing option. In the list, select the desired option.

Setting the *Bins type* to *Automatic bins*results in adjacent bars that cover all the data from the*Minimum bin*value to the last bin maximum value. For example, if the bin *Minimum bin* is 30, the *Number of bins* is 7, and the *Bin size* is 10, there are 7 bins: 30 to 40, 40 to 50, 50 to 60,..., 90 to 100. The data in the bins are greater than the minimum bin values and less than or equal to the maximum bin values.

Setting the *Bins type* to *Custom bins*, allows the user to set the minimum and maximum value for each bar individually. To create custom bins, change the *Bins type*to*Custom bins*. Click the*Edit*button next to the*Bins*command to open the**Custom Bins**dialog where you can set the custom values. When using *Custom bins*, the first bin can have no minimum, and the last bin can have no maximum, if desired.

Custom Bins

To set the bin ranges individually select *Custom bins* from the *Bins type* list and then click the *Edit* button next to *Bins* to open the Custom Bins dialog. After setting the bin minimum and maximum values, click *OK* and the custom bins are displayed.



These two histograms display the same data. The histogram on the left uses
automatic bins. The histogram on the right uses custom bins.

Change Axes

Click on the axis name next to the *X axis* or *Y axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis* or *Y axis* lists.

Position

The *Position* option controls the location of the plot on the depth axis of the 3D plot. For example, 0 percent places the plot at the front of the graph, 100 percent places the plot at the back of the graph, and 50 percent places the plot in the middle of the graph. To change the position, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the  to increase or decrease the position of the plot.

Width

The *Plot width* controls the width of the plot. Plots can be 0.01 to 6 inches (0.025 and 15.24 cm) wide. To change the width, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the  to increase or decrease the width of the plot.

New Plot

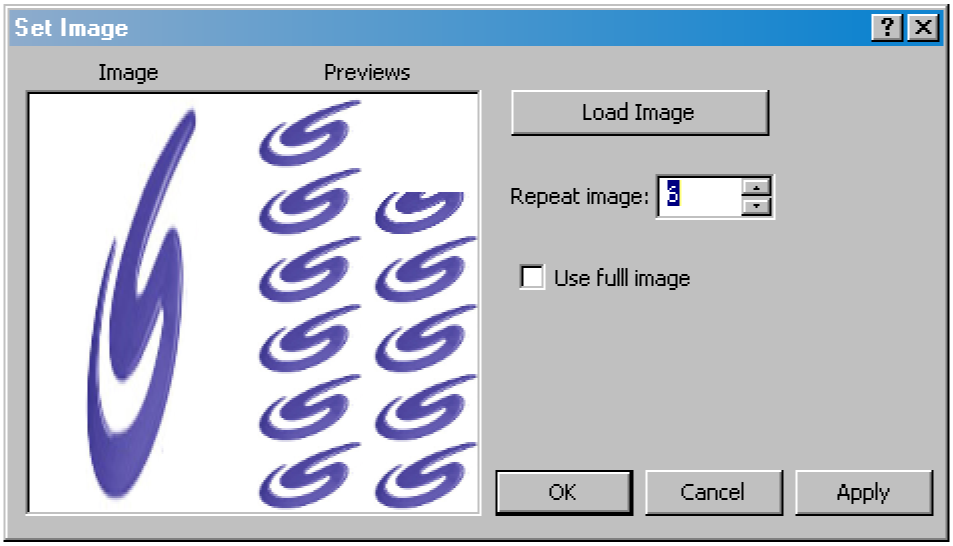
Click the *Create* button next to the *New plot* command to create a new plot based on the current data file. A new plot is created using the same *Data column* as the selected plot. The line, fill, and/or symbol color automatically changes to a new color. The *Plot palette* option on the **Options** dialog Plots page controls the colors for plots added via the *Create* button in the **Plot** page.

Fit Curves

Click the **Home | Add to Graph | Fit Curve** command to add a fit curve to the graph. This allows a normal distribution (Gaussian), Lognormal distribution, Exponential distribution, Power distribution, or Inverse Gaussian distribution fit curve to be added to the histogram. A normal distribution is added by default.

Set Image Dialog

Use the **Set Image** dialog to specify an image to use when creating a histogram, bar chart, or floating bar chart. To display the **Set Image** dialog, click on the histogram, bar chart, or floating bar chart in the Object Manager or plot window to select it. In the Property Manager, click on the **Plot** tab. Change the *Bar style* to *Image*. Click the*Load*button next to the*Set image*command to open the**Set Image**dialog.



*Use the **Set Image** dialog to specify an image to use when creating a histogram.*

Image

The *Image* section displays the loaded image, as it appears without duplication. The image is adjusted to fit in the box, so it may not appear exactly as the full image appears.

Previews

The *Previews* section displays a preview of the image, repeated the specified number of times. The left side of the preview shows the image repeated the exact number from the*Repeat image*option. The right side of the*Previews*shows a second shorter bar. If the*Use full image*box is checked, the smaller bar shows only full images. If the*Use full image*box is not checked, the smaller bar shows what the bars will look like with the image truncated at the top.

Load Image

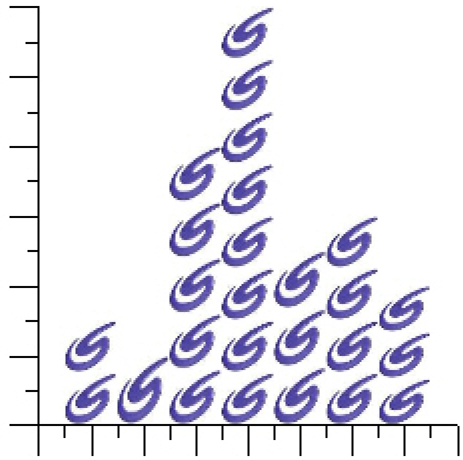
Click the *Load Image* button to open the **Import** dialog. In the **Import**dialog, select an image file and click *Open*. The image is loaded into the**Set Image**dialog.

Repeat Image

Enter a value in the *Repeat image* box to display the image multiple times in each bar in the bar chart, floating bar chart, or histogram. The *Repeat image*value is used for the longest bar. Other bars are scaled using less of the images.

Use Full Image

Check the *Use full image* box to prevent the image from being cut off. If the *Use full image*is checked, each bar can use a slightly different height image to fill the entire bar.



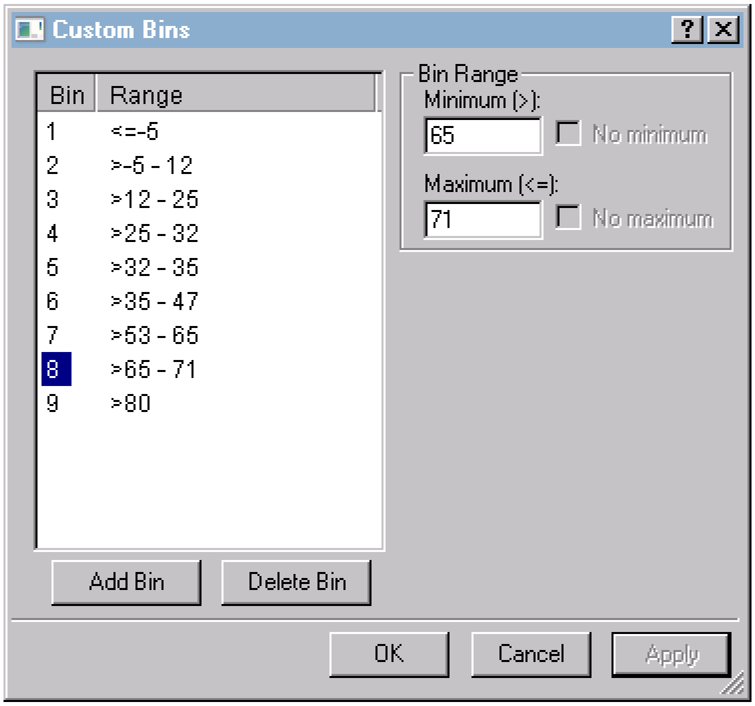
This histogram uses a repeating image with the Use full image*box checked.*

OK, Cancel, Apply

Click *OK* to close the dialog and save your changes. Click *Cancel* to close the dialog without saving your changes. Click*Apply*to see your changes without closing the dialog.

Custom Bins

There are automatic and custom binning options in **Grapher**. Use the **Cus-tomBins** dialog to define custom bins and labels when creating or editing a histogram, rose diagram, wind chart, and 3D histogram.



*Set the histogram, rose diagram, or wind chart bin ranges in the**Custom Bins**dialog.*

To Open the Custom Bins Dialog:

1. Select a histogram, rose chart, wind chart, or 3D histogram.
2. Click the **Plot** tab in the Property Manager.
3. Set the *Bins type* to *Custom bins*.
4. Click the *Edit* button next to *Bins* to open the **Custom Bins** dialog.

Minimum

The value in the *Minimum (>)* box indicates the minimum value for the selected bin. This value is not included in the bin. To change the *Minimum*value, highlight the existing value and type a new number.

No Minimum

Check the *No minimum* box if this is the first bin in the plot. If the *No minimum* box is checked, all values less than or equal to the value in the *Maximum* box will be included in this bin. After the box is initially checked, it is disabled for all other bin definitions.

Maximum

The value in the *Maximum (<=)* box indicates the maximum value for the selected bin. This value is included in the bin. To change the *Maximum*value, highlight the existing value and type a new number.

No Maximum

Check the *No maximum* box if this is the last bin in the plot. If the *No maximum* box is checked, all values greater than the value in the *Minimum* box will be included in this bin. After the box is initially checked, it is disabled for all other bin definitions.

OK or Cancel

Click *OK* to make the custom bin changes and return to the plot window. Click *Cancel* to return to the plot window without making the change.

To Create Customized Bins:

1. In the **Custom Bins** dialog, click the *Add Bin* button.
2. In the New Bin Range dialog, enter the bin minimum and maximum and click the *OK* button.
3. Click the *Add Bin* button and follow steps 1 and 2 above until all bins have been added.
4. Click the *OK* or *Apply* button to draw the custom bins.

To Edit Customized Bins:

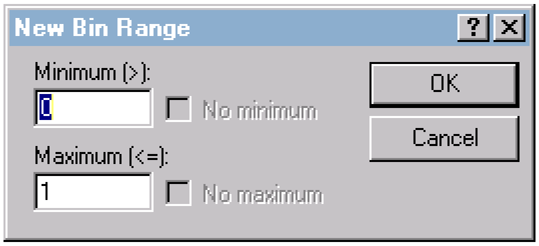
1. In the **Custom Bins** dialog, click on the bin number in the list on the left side of the dialog.
2. Change the bin minimum or maximum in the *Bin Range* section.
3. Click the *OK* or *Apply* buttons to draw the new bin.

To Delete a Bin:

1. In the **Custom Bins** dialog, click on the bin number in the list on the left side of the dialog.
2. Click the *Delete Bin* button.
3. Click the *OK* or *Apply* buttons to draw the new bins.

New Bin Range Dialog

The **New Bin Range** dialog appears when setting custom bin values for a histogram, 3D histogram, rose diagram, or wind chart. This dialog allows each bin to have a custom defined minimum and maximum value. It also allows the number of bins to be customized.



*The **New Bin Range** dialog sets the minimum and maximum values for a custom bin.*

To open the **New Bin Range** dialog,

1. Select a histogram, rose diagram, wind chart, or 3D histogram.
2. Click the **Plot** tab in the Property Manager.
3. Set the *Bins type* to *Custom bins*.
4. Click the *Edit* button next to *Bins* to open the Custom Bins dialog.
5. In the **Custom Bins** dialog, click the *Add Bin* button to open the **New Bin Range** dialog.

Minimum

The value in the *Minimum (>)* box indicates the minimum value for the selected bin. This value is not included in the bin. To change the *Minimum*value, highlight the existing value and type a new number.

No Minimum

Check the *No minimum* box if this is the first bin in the plot. If the *No minimum* box is checked, all values less than or equal to the value in the *Maximum* box will be included in this bin. After the box is initially checked, it is disabled for all other bin definitions.

Maximum

The value in the *Maximum (<=)* box indicates the maximum value for the selected bin. This value is included in the bin. To change the *Maximum*value, highlight the existing value and type a new number.

No Maximum

Check the *No maximum* box if this is the last bin in the plot. If the *No maximum* box is checked, all values greater than the value in the *Minimum* box will be included in this bin. After the box is initially checked, it is disabled for all other bin definitions.

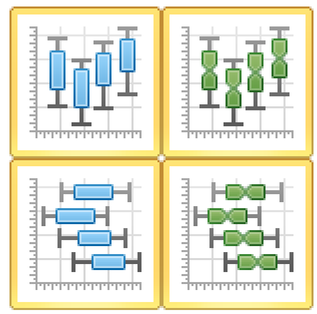
OK or Cancel

Click *OK* to make the change to the selected bin and return to the **Custom Bins** dialog. Click *Cancel* to return to the **Custom Bins** dialog without making the change.

Box Plots

Click the **Home | New Graph | Statistical | Vertical Box Plot** or **Home | New Graph | Statistical | Notched Vertical Box Plot** command to show the minimum, maximum, median, lower quartile, and upper quartile for a particular X group.

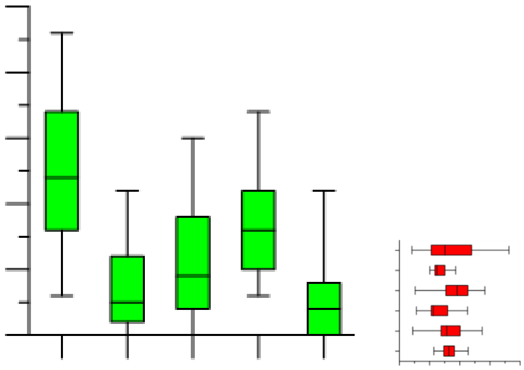
Click the **Home | New Graph | Statistical | Horizontal Box Plot** or **Home | New Graph | Statistical | Notched Horizontal Box Plot** command to show the minimum, maximum, median, lower quartile, and upper quartile for a particular Y group.



Click the **Vertical Box Plot***;* **Notched Vertical Box Plot***;* **Horizontal Box Plot***; or* **Notched Horizontal Box Plot***buttons to create box and whisker plots.*

Box plot and notched box plot orientation cannot be changed once the plot is created. You must delete the existing plot and create the desired plot to change the box plot orientation, e.g. from **Vertical Box Plot** to **Horizontal Box Plot**.

The caps, or whiskers, at the end of each box indicate the extreme values (minimum and maximum, inter-quartile range times a factor, or a percentage of the data), the box is defined by the lower and upper quartiles, and the line in the center of the box is the median. The values are sorted before referencing.



Box plots show extreme values, median, lower quartile, and upper quartile information for groups of data.

In addition, the box plot options let you display symbols for each of the outlier samples in your data group. The definitions of these terms are:

Term	Definition
Median	For an odd number of data points, this is the middle value. For an even number points, it is the mean of the middle values.
First Quartile	Value[(0.25 x (number of data points) + 0.5, rounded off to nearest whole number]
Third Quartile	Value[0.75 x (number of data points) + 0.5, rounded off to nearest whole number]

Creating a New Box Plot

To create a 2D box-whisker plot:

1. Click the **Home | New Graph | Statistical | Vertical Box Plot**;**Home | New Graph | Statistical | Notched Vertical Box Plot**; **Home | New Graph | Statistical | Horizontal Box Plot**; or **Home | New Graph | Statistical | Notched Horizontal Box Plot** command
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open work-sheets* section.
3. Click the *Open* button. A box-whisker plot is created using the default properties.

Editing Box Plot Properties

To change the features of a box-whisker plot— including the columns used to create the plot— first select the box plot in the plot window or Object Managerand then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Labels

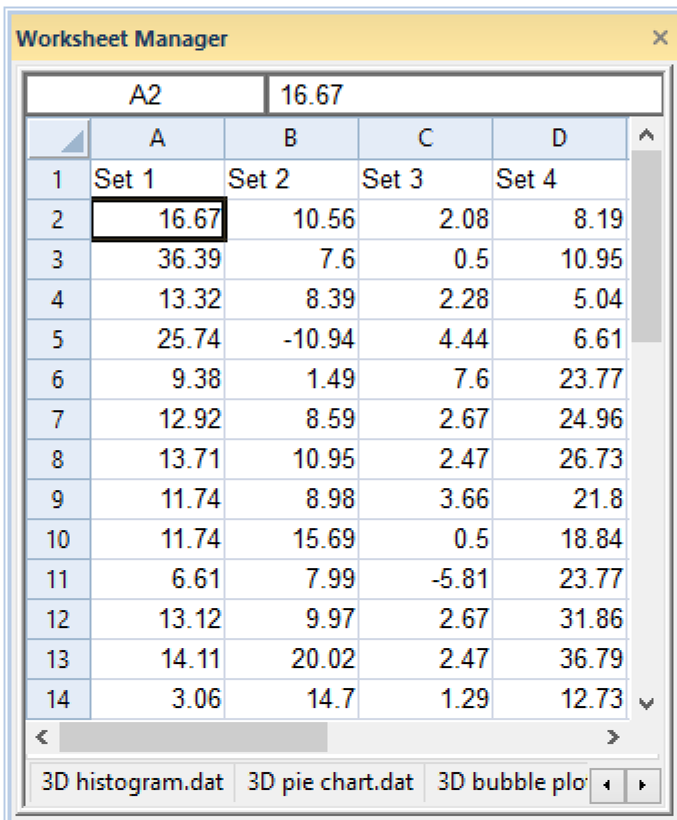
Symbol

Line

Fill

Box Plot Data

Box plot data should be in columns for each category. In the example graph shown below, Test 1, Test 2, Test 3, and Test 4 are the four categories. Box plots are ideal for making comparisons between data sets such as these.



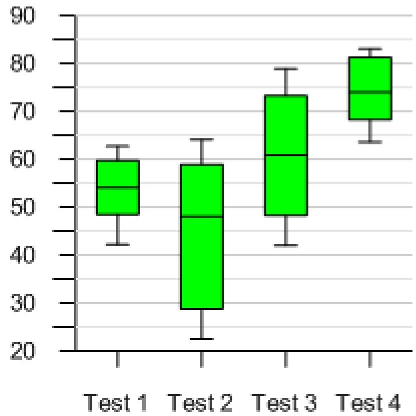
Worksheet Manager

A2	16.67

	A	B	C	D
1	Set 1	Set 2	Set 3	Set 4
2	16.67	10.56	2.08	8.19
3	36.39	7.6	0.5	10.95
4	13.32	8.39	2.28	5.04
5	25.74	-10.94	4.44	6.61
6	9.38	1.49	7.6	23.77
7	12.92	8.59	2.67	24.96
8	13.71	10.95	2.47	26.73
9	11.74	8.98	3.66	21.8
10	11.74	15.69	0.5	18.84
11	6.61	7.99	-5.81	23.77
12	13.12	9.97	2.67	31.86
13	14.11	20.02	2.47	36.79
14	3.06	14.7	1.29	12.73

3D histogram.dat | 3D pie chart.dat | 3D bubble plo

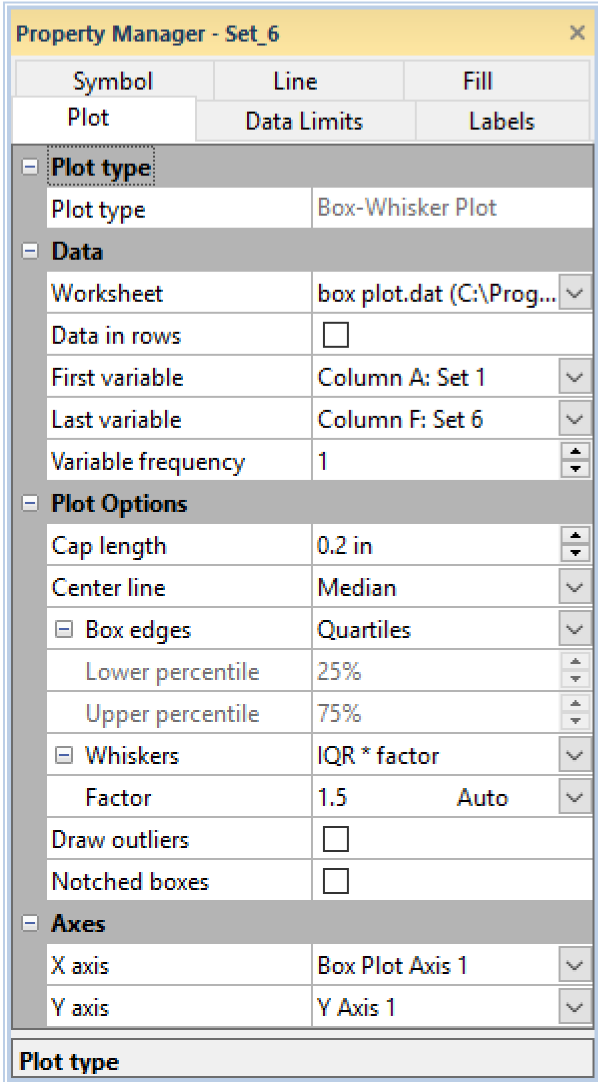
This sample data set displays four categories.



Each column of data is plotted as a box and whiskers.

Plot Page - Box Plots

To view and edit box plot properties, select the box plot and then click the **Plot** tab in the Property Manager. You can then change the axes; change the data file; and set data used in the box plot.



*Set box-whisker plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data path next to *Worksheet* to open a list containing a list of all open worksheets plus a *Browse* command. Choose one of the listed data files or click the *Browse* command to launch the **Open Worksheet** dialog and navigate to another data file.

To change multiple plots' worksheets simultaneously, first select all plots in the Object Manager, then change the *Worksheet* property in the Property Manager.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Select the data to use in the box plot in the *First column* and *Last column* fields. Click the down arrows to view all columns available to use in the box plot. If the first worksheet row contains header information, the header information appears next to the column letter.

The box plot data need to be arranged in columns for each category. In the *First column* list, select the first data column that you want to plot. In the *Last column* list, select the final column that you want to plot. By default, all data columns between the *Firstcolumn* and *Lastcolumn* are included in the plot.

Use the *Column frequency* option to skip columns of data in the plot. For example, if *Column step* is set to 2, every other column is plotted on the graph. When the *Column step* is greater than 1, the first column displayed is the *First column*. The next column to display is the *First column* + the *Column frequency*. For instance, if the *First column* is Column E, the *Last column* is Column AE and the *Column frequency* is 8, the columns E, M, U, and AC are displayed in the box plot.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Cap Length

The *Cap length* adjusts the length of the cap lines (whiskers) on either end of the lines. To display the box plot without the whiskers, set the value for the *Cap length* to zero. To change the *Cap length*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the *Cap length* value.

Center Line

The *Center line* property sets which statistical value is represented by the line in the box. Select *Median* or *Mean* in the *Center line* list.

Box Edges

The box extents are determined by the *Box edges* property. Select the desired statistical value for the box extents in the *Box edges* list:

- *Quartiles* sets the box extents to the first and third quartiles, i.e. the 25th and 75th percentiles.
- *Percentiles* enables the *Lower percentile* and *Upper percentile* properties. Specify the percentile you wish to indicate with the box edge in either the *Lower percentile* or *Upper percentile* field and the other property will automatically update.
- *Confidence level* sets the box extents to the confidence interval. Specify the confidence level in the *Level* property. The *Level* can be between 50% and 99%.
- *Standard deviation* sets the box extents at one or more standard deviations from the mean. Specify the number of deviations in the *# deviations from mean* property field.
- *Standard error* sets the box extents at one or more standard errors from the mean. Specify the number of errors in the *# of errors from mean* property field.
- *Minimum/maximum* sets the box extents at the data minimum and maximum.
- *Average* sets the box extents at the average value of all data points above the mean and all data points below the mean.

Whiskers

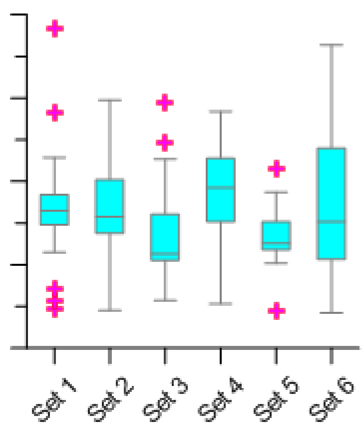
The *Whiskers* controls where the cap lines (whiskers) are drawn. Available options are,

- IQR*factor calculates the whiskers based on the interquartile range. The Factor value determines how far the whiskers extend beyond the box based on the inter-quartile range. The Factor value does not appear to change the plot unless the Draw outliers box is checked.

- Minimum/Maximum places the whiskers at the absolute smallest and largest values in the data.
- Percentile places the whiskers at the specified percentage of the data. Specify the percentile range in the Lower percentile or Upper percentile property field.
- Standard deviation places the whiskers at one or more standard deviations from the mean. Specify the number of deviations in the # deviations from mean property field.
- *Standard error* places the whiskers at one or more standard errors from the mean. Specify the number of errors in the *# errors from mean* property field.

Draw Outliers

When the *Draw outliers* box is checked, a symbol is placed at the outlying points and the whisker value is recalculated, if necessary.



You can display outlier symbols on box whisker plots.

An outlier is any point that falls outside the whiskers. When the *Whiskers* option is set to *IQR*factor*, this is any value below QL – Factor*IQR or above QU + Factor*IQR.

where

- IQR is the interquartile range, the difference between the first and third quartiles.
- QL is the value of the lower quartile (bottom of the box).
- QU is the value of the upper quartile (top of the box).
- The default *Factor* value (1.5) can be changed.

If the *Draw outliers* box is not checked, some points may not be displayed in the box-whisker plot, depending on the *Whiskers* option.

Outlier Symbol

Click the Symbol page to edit the outlier symbol size, fill or line properties.

Notched Boxes

Check the box next to *Notched boxes* to display indented notches at the *Notch factor*. The notches surrounding the median value provides a measure of the rough significance of differences between the median values. When the *Notch factor* is set to the default value of 1.7, the notches display approximately the 95% confidence level in the median. If the notches about two medians overlap, the medians of the two boxes are considered the same within the confidence level. When the notches do not overlap, the medians are considered significantly different. When the notch is outside the box (larger than the difference between the first quartile and the median or the third quartile and the median), the box is displayed as inverted. This indicates a low level of confidence in the median.

Notch Factor

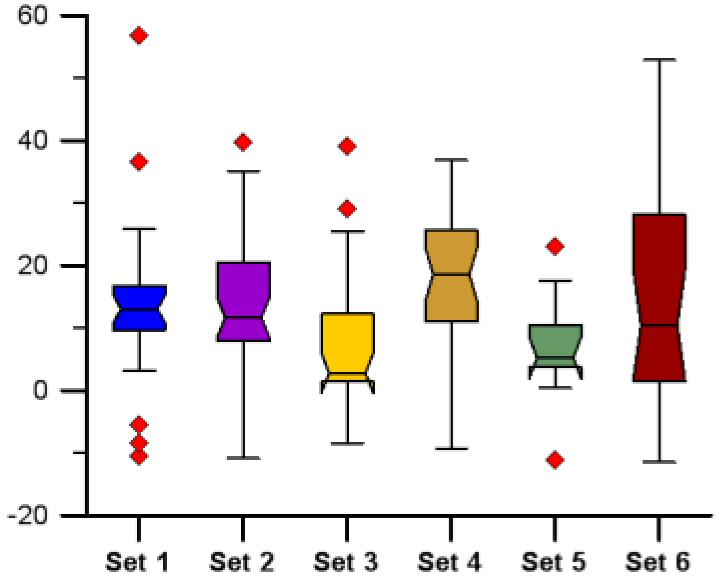
The *Notch factor* is the value multiplied by the standard deviation of the median. The default *Notch factor* of 1.7 approximately shows 95% confidence in the median. To increase the degree of confidence in the median values, increase the *Notch factor*. For most cases, a value of 1.96 would show approximately 99% confidence in the medians. A smaller value would result in a more conservative a test of the confidence. Appropriate values range between approximately 1.3 and 1.96. The value must be greater than zero. To change the *Notch factor*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. To return the *Notch factor* to the default value, click the word *Custom*.

Change Axis

Click the *Y axis* field to change the Y axis used for a vertical box plot. Click the *X axis* field to change the X axis used for a horizontal box plot. Choose *Select plots/axis* to change the axis used by several plots on a graph. The X axis cannot be changed for a vertical box plot, and the Y axis cannot be changed for a horizontal box plot.

Example

In the example below, the *Whiskers* are set to *IQR*factor*, where the factor is 1.5. The notches are displayed at the *Notch factor* of 1.7, displaying 95% confidence in the medians. The blue, purple, and red bars sets have overlapping notches. This indicates that these three sets have the same median value, with 95% confidence. The yellow, gold, and green boxes do not overlap the blue, purple and red bars indicating that these sets have different median values within the confidence. The yellow and green boxes have inverted notches, indicating that additional observations are required to have better confidence in the calculated median value.



The notched box-whisker plots add additional levels of confidence to the calculated median values.

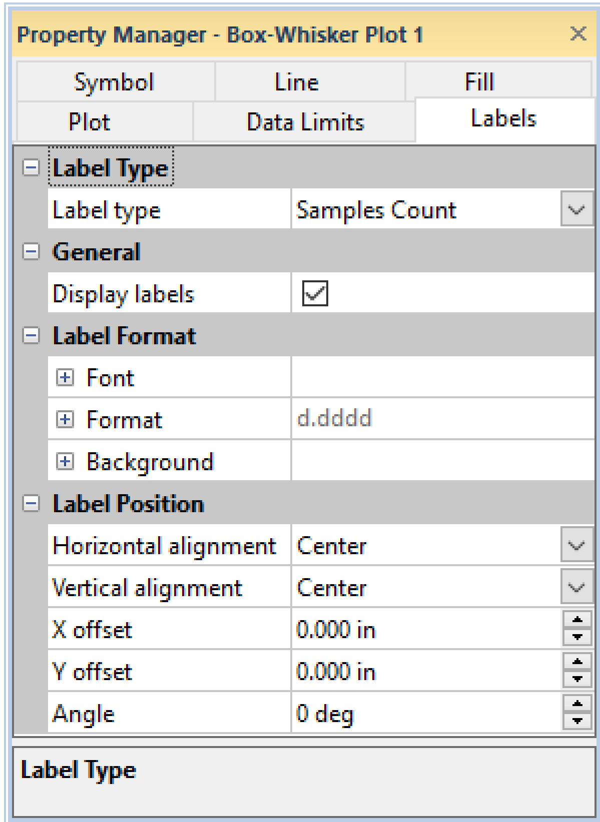
References

Robert McGill; John W. Tukey; Wayne A. Larsen, *Variations of Box Plots*, The American Statistician, Vol. 32, No. 1 (February 1978), pp. 12-16.

Labels Page - Box Plots

Data point labels can be shown on most plot types in **Grapher**. For a box plot, the labels can show the number of samples, the first quartile value, the third quartile value, the median value, the top and bottom whisker value, the minimum and maximum values, any outlier values, and the notch values. Labels can also be customized to appear in specific locations and can use a variety of formats, fonts, and colors to optimize the look of the graph.

The following information is for the options contained on the box-whisker plot **Labels** tab. To edit the labels, click on a box plot to select it. In the Property Manager, click on the **Labels**tab.



*Set label properties in the **Property Manager** on the **Labels** tab.*

Label Types

For a box plot, the labels can show the number of samples, the first quartile value, the third quartile value, the median value, the top and bottom whisker value, the minimum and maximum values, any outlier values, and notch values.

The *Label type* property determines which labels are currently being edited by the **Property Manager**. Select the label you wish to display in the *Label type* field, then select the *Display labels* option to show that label type on the plot.

The *Samples Count* displays the number of points used to calculate each box set. This is the number of points in the sample column. The *Samples Count* is displayed at the center of the box, by default.

The *Quartiles (25)* displays the first quartile value. The first quartile value is calculated by **Grapher** using the equation

Value[(0.25(number of data points) + 0.5, rounded off to nearest whole number].*

The first quartile value is displayed above the bottom of the box, by default.

The *Median (50)* displays the median value. The median value is calculated by **Grapher** using the equation

For an odd number of data points, this is the middle value. For an even number points, it is the mean of the middle values.

The median value is displayed above the median line, by default.

The *Quartiles (75)* displays the third quartile value. The third quartile value is calculated by Grapher using the equation

Value[0.75(number of data points) + 0.5, rounded off to nearest whole number]*

The third quartile value is displayed below the top of the box, by default.

The *Whisker (lower)* displays the label for the lower whisker value. The *Whisker (upper)* displays the label for the upper whisker value. The whisker value is determined based on the *Whisker* setting on the Plot page.

The *Minimum* and *Maximum* display labels next to the smallest and largest data points in the box-whisker plot. When outliers are displayed as symbols, the label for the *Minimum* value will be below the outlier symbol. The label for the *Maximum* value will be above the outlier symbol.

The *Outliers* labels displays a label next to each outlier when outliers are displayed as symbols. The label for the *Outliers* display to the right of the outlier symbol.

The *Notches* labels displays a label to the right of the median line with a +/- value, where the value is the distance from the median to the notch.

All labels can be moved with the Graph Tools | Plot Tools | Move Labels command.

Display Labels

Each label type can be individually set whether to be displayed or not. Select the desired label type in the *Label type* field, such as *Samples Count*. Then, check the box next to the *Display* option to add the specific label to the plot. To display multiple types of labels, open each label section and check the box next to the *Display* option.

Label Format

The *Label Format* section includes the Font, Format, and Background properties for the plot labels.

Label Font

Click the ⊞ next to *Font* to set the label font properties. The font *Face, Size (points), Color, Opacity, Bold, Italic, Underline,*and*Strikethrough*properties can be set for most labels.

Label Format

Click the ⊞ next to *Format* to set the label format properties. The label *Type,* display of numbers, *Prefix,* and *Suffix* can be set for labels.

Label Background

Click the ⊞ next to *Background* to set the label background properties. The *Background* is the area behind the label. Click the ⊞ next to *Line* to set the line properties for the line that goes around the text. Click the ⊞ next to *Fill* to set the fill properties for the area around the text.

Label Position

The *Label Position* section includes properties for defining the label position and rotation.

Horizontal Alignment

The plot label can be positioned relative to the data point vertically, horizontally, and by specified amounts. *Horizontal alignment* controls the horizontal placement of the labels. You can position the labels to the *Left* or *Right* of the data point, *Center* the labels on the data point, or alternate the position of the labels to the left and right of neighboring data points (*Alternate left-right*). To change the horizontal placement of the labels, click the existing option and select the desired option from the list.

Vertical Alignment

Vertical alignment controls the vertical position of the data label. You can position the labels *Above* or *Below* the data point, *Center* the labels on the data point, or alternate the position of the labels above and below neighboring data points (*Alternate above-below*). To change the vertical placement of the labels, click the existing option and select the desired option from the list.

Label Offset

Labels can be positioned at a custom position by entering values into the *X offset* or *Y offset* boxes. Entering a positive value into the offset box moves the label up for the *Y offset* or to the right for the *X offset*. Entering a negative value in the offset box moves the label down for the *Y offset* or to the left for the *X offset*.

Angle

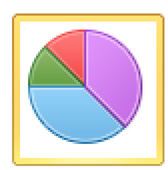
You can enter a number into the *Angle* box to rotate the data point labels. Positive values rotate the label in a counter-clockwise direction. The *Angle* is specified in degrees. To enter an angle, highlight the existing value and type a new value. Alternatively, click the  to increase or decrease the value. Press ENTER on the keyboard to make the change.

Label Leader Line

Label leader lines can be used to connect the text label to the data point. If the edge of the label is further than 0.1 inches (0.254 centimeters) away from the data point, label lines are displayed. This normally means that label lines are displayed if labels have been moved with the Move Labels command or if the *X offset* or *Y offset* values have been changed from zero. The line goes from the label to the point. Line properties can be changed for the label lines. To change the label line properties, change the properties in the *Label Leader Line Properties* section of the Line page.

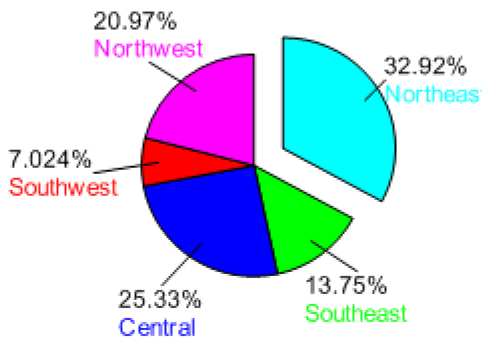
Pie Charts

Click the **Home | New Graph | Statistical | Pie Chart** command to display data as proportional slices of a circle. Each data value is divided by the sum of all the data to determine the size of the slice. The data with the largest proportions appear as the largest slices. All data for a pie chart must be in a single column for data and an optional single column for labels.



Click the ***Pie Chart*** *button to create a pie chart.*

After being created, pie charts contain each row as a separate slice of the pie. The pie chart is automatically labeled with two labels. The top label is the text in the worksheet's label column. The second label is the percentage of the pie or data value for that slice. Either label can be altered to display data value, as well.



Pie charts show data as proportions of a circle.

Creating a New Pie Chart

To create a pie chart:

1. Click the **Home | New Graph | Statistical | Pie Chart** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A pie chart is created using the default properties.

Editing Pie Chart Properties

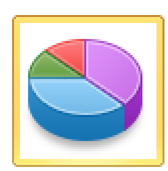
To change the features of a pie chart— including the columns used to create the chart— first select the chart in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot
Slices
Title
Labels
Line

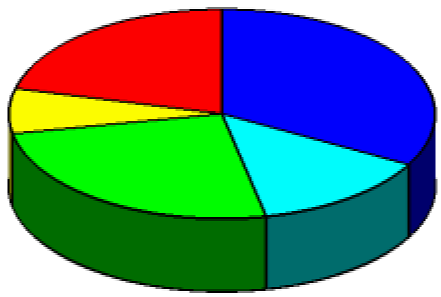
3D Pie Charts

Click the **Home | New Graph | Statistical | 3D Pie Chart** command to display data as proportional slices of a cylinder. Each data value is divided by the sum of all the data to determine the size of the slice. The data with the largest proportions appear as the largest slices.



Click the ***3D Pie Chart*** *button to create the pie chart with a 3D appearance.*

After being created, 3D pie charts contain each row as a separate slice of the pie. The pie chart is automatically labeled with two labels. The top label is the text in the worksheet's label column. The second label is the percentage of the pie for that slice. Either label can be altered to display data value, as well.



3D pie charts are pie charts with an added depth option.

Creating a New 3D Pie Chart

To create a 3D pie chart:

1. Click the **Home | New Graph | Statistical | 3D Pie Chart** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A 3D pie chart is created using the default properties.

Editing 3D Pie Chart Properties

To change the features of a 3D pie chart— including the columns used to create the chart— first select the chart in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Slices

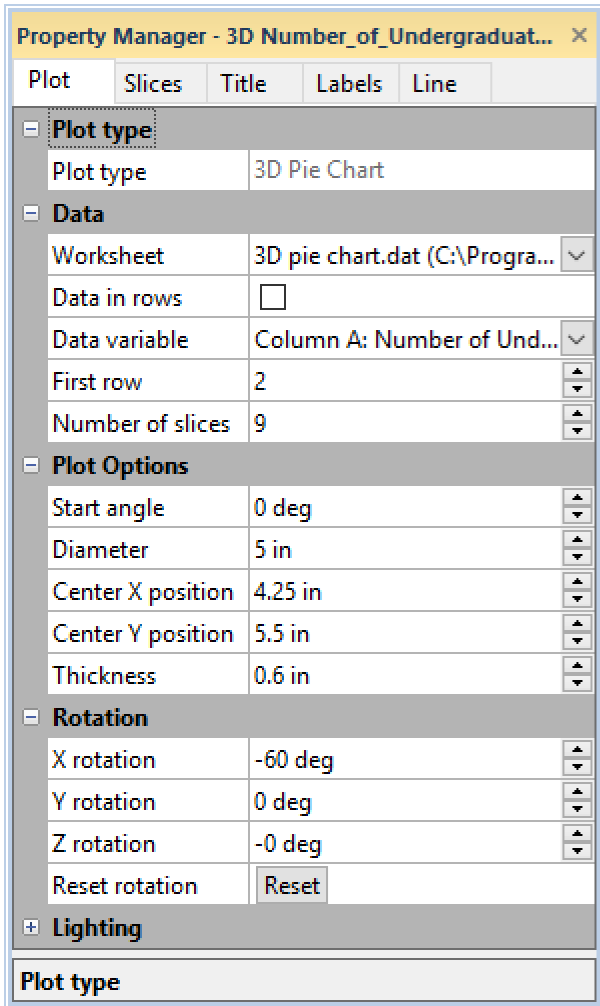
Title

Labels

Line

Plot Page - Pie and Doughnut Charts

The pie chart properties **Plot** page contains the options to change the data file, set data used in the plot, and edit the number of slices. To view and edit pie chart properties, click on the pie chart in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the pie chart properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Data in Rows

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *Data column* field to change the column used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter. The *Data column* is the column being displayed as the slice.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Limiting the Data

Choose the range of rows to plot in a pie chart. The default rows are the first and last rows containing data.

To limit the range of the plotted data, you can change the range of rows. The *First row* is the worksheet row value for the first row to be included as a slice in the pie chart. The *Number of slices* option lists how many slices should be included in the pie chart. To limit the range of the plotted data, you can change the range of rows. Highlight the existing value in either the *First row* or *Number of slices* boxes. Type a new value or click the to scroll to a new value. Press ENTER on the keyboard to update the pie chart. The *Number of slices* must be an integer between 1 and 200. No more than 200 slices can be displayed on a pie chart at one time.

When changing the *Data column* or *Worksheet*, the *Number of slices* automatically updates to include all of the rows containing data for the new worksheet or column.

Start Angle

The *Start angle* option lets you rotate the pie chart by a fixed number of degrees. Zero degrees points directly up on the pie chart. The first data value is drawn with the left edge of the slice on the vertical line and the right edge is drawn clockwise from this line. Entering positive numbers in the *Start angle* rotates the pie clockwise. Entering negative numbers in the *Start angle* rotates the pie counterclockwise. To change the *Start angle*, highlight the existing value and type a new value. Alternatively, click the to increase or decrease the angle. Press ENTER on the keyboard to update the pie chart.

Diameter

The *Diameter* option controls the size of the pie chart. By default, a new pie chart or 3D pie chart is 5.00 inches in width, not including any labels that extend outside the pie circle or exploded pie slices. To change the size of the pie chart, highlight the existing value and type a new value. Press ENTER on the keyboard to update the pie chart. Alternatively, click the to increase or decrease the pie chart size. The size of the pie chart is in page units and can be set to any value from -200 to +200 inches.

The pie chart can also be resized by clicking on the bounding box and dragging the size. When the pie chart contains exploded pieces, dragging the size could result in a non-circular area. In this case, the size should be set with the *Diameter* option.

Center X Position

The *Center X position* option controls the location of the pie chart in the horizontal direction. The position controls the center location of the pie chart where all of the pie pieces touch. To change the pie chart location, highlight the existing value and type the desired value. Alternatively, click the to increase or decrease the value. Pie charts can also be moved by clicking and dragging the pie chart to the desired location. The position is in page units and can be set to any value from -100 to +100 inches.

Center Y Position

The *Center Y position* option controls the location of the pie chart in the vertical direction. The position controls the center location of the pie chart where all of the pie pieces touch. To change the pie chart location, highlight the existing value and type the desired value. Alternatively, click the to increase or decrease the value. Pie charts can also be moved by clicking and dragging the pie chart to the desired location. The position is in page units and can be set to any value from -100 to +100 inches.

Thickness

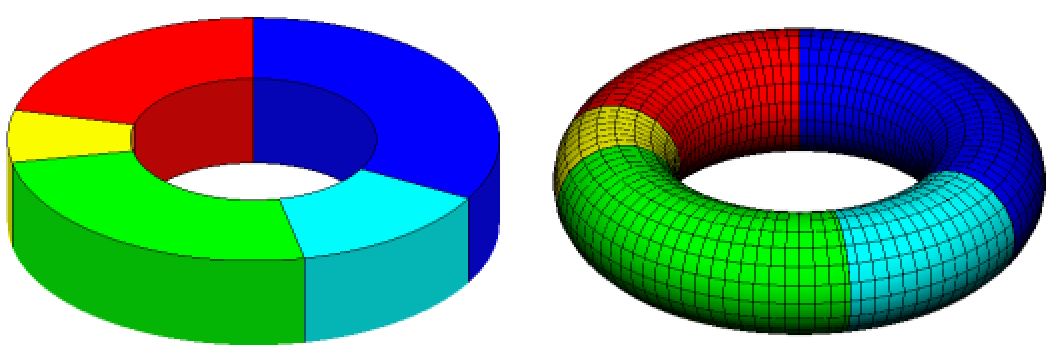
The *Thickness* option is available for 3D pie charts. The *Thickness* determines how thick the 3D pie chart is displayed. To change the *Thickness,* highlight the existing value and type a new value. Alternatively, click the to increase or decrease the thickness. Press ENTER on the keyboard to update the pie chart. The *Thickness*is in page units and can be set between 0 and 6 inches (0.0 and 15.24 centimeters).

Hole Size

The *Hole size* controls how large the center hole is with respect to the entire doughnut plot. The value is a percentage, varying from 0% to 95%. The larger the value, the larger the hole in the center of the doughnut plot. To change the value, highlight the existing value and type a new value. Press ENTER on the keyboard to update the plot. Alternatively, click the to increase or decrease the size of the hole.

Shape

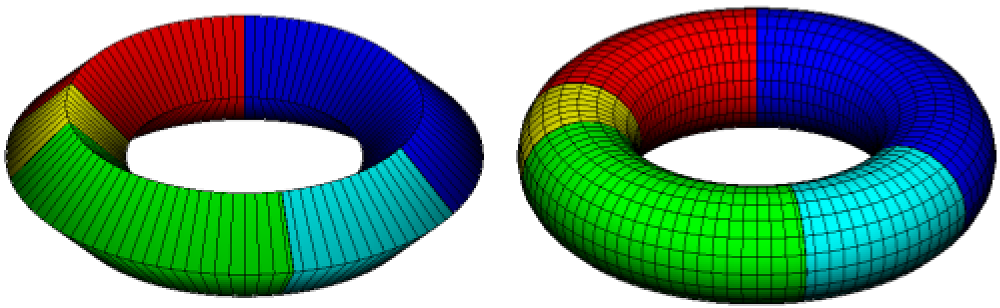
The *Shape* option is available for 3D doughnut plots. The *Shape* controls the how the 3D object is drawn. To change the *Shape*, click on the existing option and select the desired option from the list. Available options are *Torus* and *Disk*. When *Torus* is selected, the *Number of sides* and *Number of segments* options are also available.



The two plots display the same data. The doughnut plot displays the disk shape. The doughnut plot on the right displays the torus shape.

Number of Sides

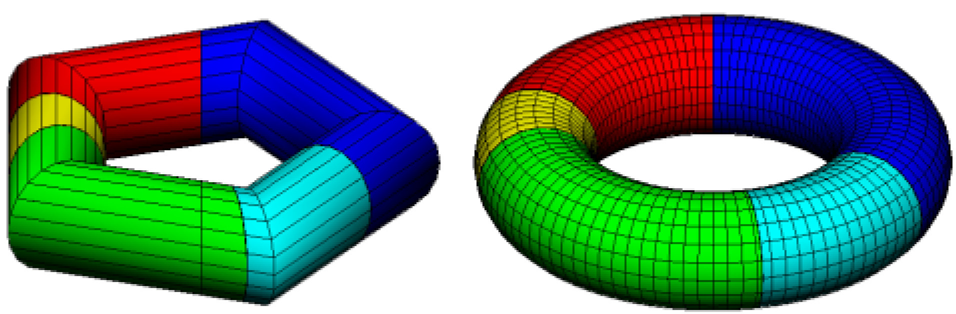
The *Number of sides* option is available for 3D doughnut plots when the *Shape* is set to *Torus*. The *Number of sides* controls how smooth the rounding is on the torus. To change the *Number of sides*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the number of sides. The value can be from 2 to 100. The default is 20 sides.



The two plots display the same data. The doughnut plot on the left contains four sides. The doughnut plot on the right contains 20 sides.

Number of Segments

The *Number of segments* option is available for 3D doughnut plots when the *Shape* is set to *Torus*. The *Number of segments* controls how circular the ring is for the torus. To change the *Number of sides*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the number of sides. The value can be from 3 to 200. The default is 100 segments.



The two plots display the same data. The doughnut plot on the left contains five segments. The doughnut plot on the right contains 100 segments.

Slices

Information about each pie slice is listed in the Slices dialog. You can set properties for each slice, such as fill color or explosion factor, in the **Slices** dialog. You can also set properties for all slices at once, for example applying a colormap to the fill colors or set the line properties. Click the *Edit*button next to the *Slices* command to edit the pie chart slice properties.

Rotation

3D plots can be rotated around X, Y, and Z axes. You can set the rotation in the *X rotation*, *Y rotation*, and *Z rotation* boxes. Positive values rotate to the left. Negative values rotate to the right. The rotation is measured in degrees from -360 to 360. To change the rotation, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the  to increase or decrease the value.

Occasionally the *X rotation*, *Y rotation*, and *Z rotation* values will update when you make a large change to one of the rotation values, deselect the object, and select the object again. Although the rotation values change the object orientation will remain the same.

Reset Rotation

Click the *Reset* button next to the *Reset position* command to reset the rotation to the **Grapher** defaults. You can also use the **Layout | Rotate | Reset Rotation** command to reset the rotation.

Rotation Tip

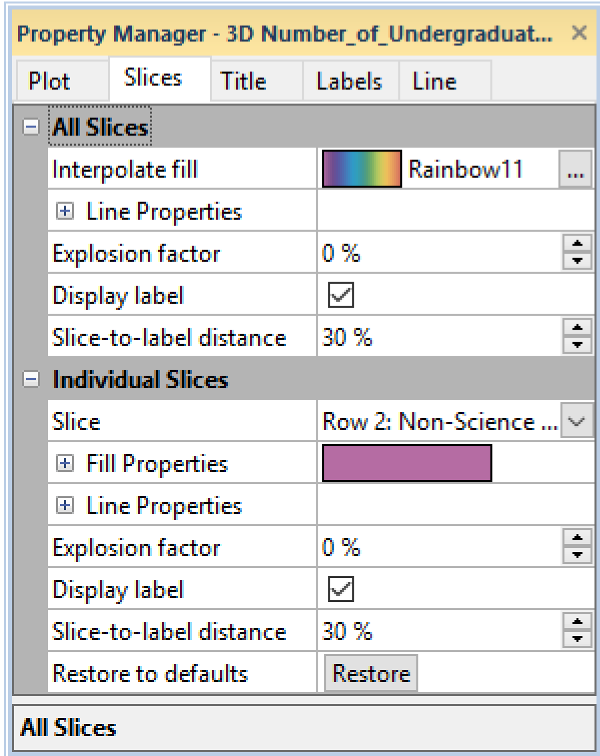
To set the rotation of a graph, click the Layout | Rotate | Custom Angle or the Layout | Rotate | Free Rotate command.

Lighting

The *Lighting* section of the **Plot** page includes the 3D lighting properties.

Slices Properties

The pie chart properties **Slices** page contains the properties of each slice for a pie chart or doughnut plot. To view and edit pie chart properties, click on the pie chart in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



Set the properties for all slices or individual slices on the ***Slices*** *page.*

All Slices Properties

The properties in the *All Slices* section affect all slices at once. Setting an *All Slices* property will overwrite previous changes made to the property in the *Individual Slices* section.

Interpolate Fill

Specify a color gradient to apply across the pie or doughnut slices in the *Interpolate fill* property. Select a predefined color gradient from the list, or click the  button to create a custom Color Gradient.

Line Properties

Set the line properties for all slice lines in the *Line Properties* section.

Explosion Factor

You can move the slices out from the center of the pie chart or doughnut plot by entering a number into the *Explosion factor* box. For example, an explosion factor of 50 percent moves the slice(s) half the distance of the slice length from the center of the chart. To change the *Explosion factor* value, highlight the existing value and type a new value. Alternatively, click the to increase or decrease the value.

Display Labels

Check the box next to the *Show label* command to show or hide slice labels.

Slice-to-label Distance

Enter a new number into the *Slice-to-label distance* box to change the distance between the label and the slice. For example, a *Slice-to-label distance* of 50 percent places the label from the slice half the distance of the slice length. To change the *Slice-to-label distance* value, highlight the existing value and type a new value. Alternatively, click the to increase or decrease the value.

Individual Slice Properties

The *Individual Slices* section includes the properties for each pie or doughnut chart slice. To edit an individual slice, select the slice in the *Slice* list.

The *Individual Slices* section includes the same properties as the *All Slices* section above, as well as *Fill Properties* for each slice.

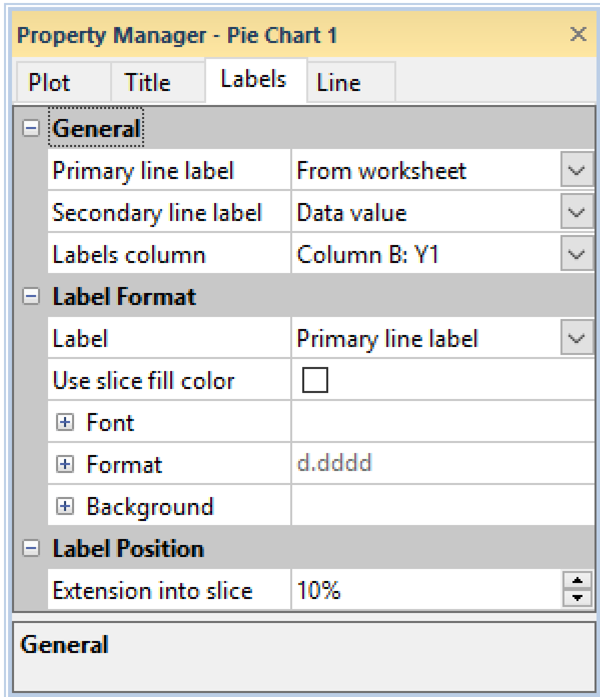
To revert changes made to an individual slice, click *Restore* in the *Restore to defaults* field to use the properties from the *All Slices* section for the pie or doughnut slice.

Labels Page - Pie Charts and Doughnut Plots

Data point labels can be shown on most plot types in **Grapher**. For pie charts and doughnut plots, the labels can show the information in the labels column, data values, or the percentage the data value is of the whole pie. Labels can also be customized to appear in specific locations and can use a variety of formats, fonts, and colors to optimize the look and feel of the graph.

After being created, pie charts and doughnut plots are automatically labeled with two labels. The top label is the text in the worksheet's label column. The second label is the percentage of the pie for that slice. Either label can be altered to display data value, as well.

The following information is for the options contained on the pie chart and doughnut plots **Labels** tabs. To edit the labels, click on a pie chart or doughnut plot to select it. In the Property Manager, click on the **Labels** tab.



Set label properties in the ***Property Manager*** *on the* ***Labels*** *tab.*

Labels

Set the *Primary linelabel* and *Secondary line label* to *None*, *From worksheet*, *Data value*, or *Percentage*.

- The *None* option hides the label.
- The *From worksheet* option uses the *Labels column*.
- The *Data value*displays the value in the*Data column*.
- The*Percentage*calculates the percentage this slice is of the entire pie chart and displays the percentage value.

To change the *First line label* or *Second line label,* click on the current option. Select the desired option from the list.

Label Format

The *Label Format* section includes the font, format, and background options for the labels.

Label

Select the label you wish to edit in the *Label* field. Select *Primary line label* to edit the font, format, and background properties for the first label. Select *Secondary line label* to edit the font, format, and background properties for the second label.

Use Slice Fill Color

Check the box next to the *Use slice fill color* command to color the labels with the same color as the foreground color of the slice.

Label Font

Click the ⊞ next to *Font* to set the label font properties. The font *Face, Size (points), Color, Opacity, Bold, Italic, Underline,* and *Strikethrough* properties can be set for most labels.

Label Format

Click the ⊞ next to *Format* to set the label format properties. The label *Type,* display of numbers, *Prefix,* and *Suffix* can be set for labels.

Label Background

Click the ⊞ next to *Background* to set the label background properties. The *Background* is the area behind the label. Click the ⊞ next to *Line* to set the line properties for the line that goes around the text. Click the ⊞ next to *Fill* to set the fill properties for the area around the text.

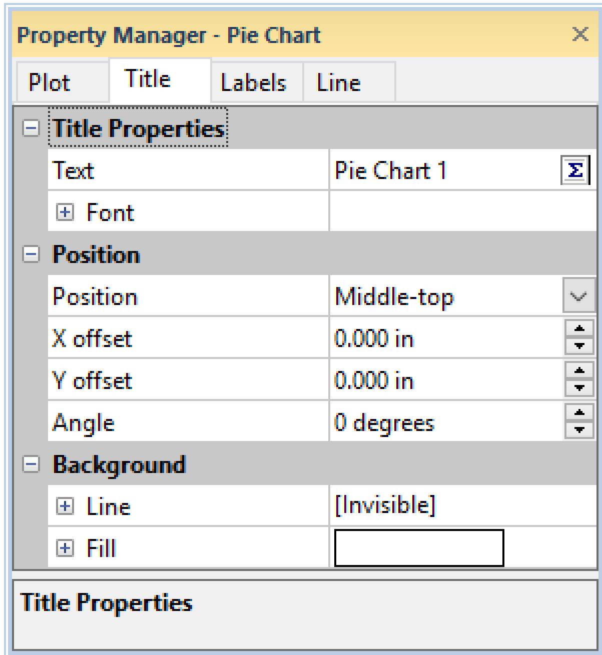
Label Line

Label lines can be used to connect the text label to the slice. Line properties can be changed for the label leader lines on the Line page.

The *Extension into slice* option determines the distance the label line extends into the slice. For example, a distance of 50 percent extends the line halfway into the slice, toward the center of the chart. To change the *Extension into slice* value, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the ⬍ to increase or decrease the extension into the slice.

Title Properties

You can add a title to an existing graph through the graph properties. Add a title to a color scale through the color scale properties. Each graph and color scale can only have one title. To view and edit graph title properties, click on the *Graph* object in the Object Manager or plot window to select it. Then, click on the **Title** tab in the Property Manager. To view and edit color scale title properties, click on the *Color Scale* object in the **Object Manager** or plot window to select. Then, click on the **Title** tab in the Property Manager.



*Set the title and title location for a graph on the **Title** page in the **Property Manager**.*

Creating a Graph Title

To add a title to a graph:

1. Select the entire graph.
2. In the Property Manager, click on the **Title** tab.
3. Click the *Editor*button next to *Title*.
4. In the Text Editor, enter the title text and select the text properties.
5. Click *OK* to add the title to the graph.

Creating a Color Scale Title

To add a title to a color scale:

1. Select the color scale.
2. In the Property Manager, click on the **Title** tab.
3. Click the *Editor*button next to *Title*.
4. In the Text Editor, enter the title text and select the text properties.
5. Click *OK* to add the title to the color scale.

See *Color Scale - Contour Maps* or Color Scale - Surface and Vector Plots for instructions on adding a color scale to a graph.

Removing a Graph Title

To remove a graph title:

1. Select the entire graph.
2. In the Property Manager, click on the **Title** tab.
3. Click the *Editor*button next to *Title*.
4. In the Text Editor, delete all of the text.
5. Click *OK* to remove the title from the graph.

Removing a Color Scale Title

To remove a color scale title:

1. Select the color scale.
2. In the Property Manager, click on the **Title** tab.
3. Click the *Editor*button next to *Title*.
4. In the Text Editor, delete all of the text.
5. Click *OK* to remove the title from the color scale.

Moving a Graph Title

To move a graph title:

1. Select the entire graph.
2. In the Property Manager, click on the **Title** tab.
3. Set the *Position*, *X offset*, and *Y offset* values.
4. If the title should be move an additional amount, click the Graph Tools | Plot Tools | Move Labels command.
5. Click on the graph title. Hold down the left mouse button and drag the title to the new location.
6. Press ESC on the keyboard to exit move labels mode.

Moving a Color Scale Title

To move a color scale title:

1. Select the color scale.
2. In the Property Manager, click on the **Title** tab.
3. Set the *Position*, *X offset*, and *Y offset* values.

Title Properties

The *Title Properties* section includes the title text and font properties. You can quickly add a title by typing directly in the *Text* field.

You can make quick font adjustments to the entire title *Text* by editing the font properties in the *Font* section. Alternatively, click the button to edit the title text and text properties in the Text Editor dialog.

Position

Set the title location by choosing one of the eight predefined positions in the *Position* list. The options are *Left-top, Middle-top, Right-top, Left-middle, Right-middle, Left-bottom, Middle-bottom,* and *Right-bottom.* To change the *Position*, click on the existing option. Select the desired option in the list.

Selecting *Left-middle* or *Right-middle* will automatically change the title orientation to vertical, i.e. the *Angle* value is *90* degrees.

X and Y Offset

Title positions can be further refined by entering values into the *X offset* or *Y offset* boxes. Entering a positive value into the offset box moves the label up for the *Y offset* or to the right for the *X offset*. Entering a negative value in the offset box moves the label down for the *Y offset* or to the left for the *X offset*. To enter an offset, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value. The offsets are set in page units.

Angle

You can enter a number into the *Angle* box to rotate the title. Positive values rotate the title in a counter-clockwise direction. The *Angle* is specified in degrees. To enter an angle, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Background Line

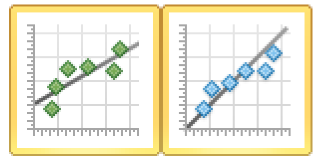
Use the *Line* settings in the *Background* section to add a border around the title. Click the next to *Line* to open the line properties section.

Background Fill

Use the *Fill* settings in the *Background* section to add a background fill to the title box. Click the next to *Fill* to open the fill properties section.

Q-Q Plots and Normal Q-Q Plots

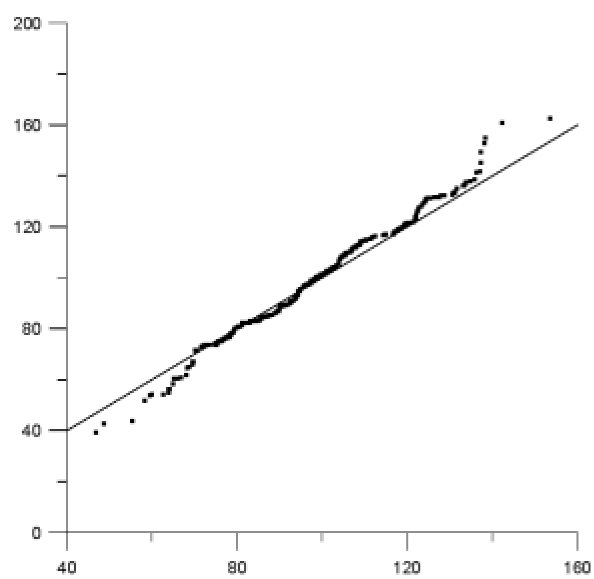
Click the **Home | New Graph | Statistical | Q-Q Plot or** the **Home | New Graph | Statistical | Normal Q-Q Plot** command to plot a Q-Q plot. A Q-Q plot is a type of probability plot which compares the probability distribution of two data sets by plotting their quantiles against each other. Each point plotted on the Q-Q plot represents the same quantile in each data set. If the two distributions being compared have similar distributions, the points will approximately lie on the line y=x. If the distributions are linearly related, the points will lie on a line, but not necessarily the y=x line.



Click the Q-Q Plot or Normal Q-Q Plot buttons to create the desired plot type.

The *Normal Q-Q Plot* plots the distribution of a single data set against the normal distribution. To change a Q-Q plot to a Normal Q-Q plot, change either the *X column* or *Y column* property on the **Property Manager** Plot page to *None*.

The y=x line is also plotted on both the Q-Q plot and the normal Q-Q plot.



Q-Q plots show data as symbols with a y=x line
This plot compares two data sets that are closely related, so the data fall almost always along the y=x line.

Creating a Q-Q Plot or Normal Q-Q Plot

To create a new Q-Q plot or normal Q-Q plot:

1. Click the **Home | New Graph | Statistical | Q-Q Plot** or the **Home | New Graph | Statistical | Normal Q-Q Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A Q-Q plot or normal Q-Q plot is created using the default properties.

Editing an Q-Q Plot or Normal Q-Q Plot

To change the features of a Q-Q plot or a normal Q-Q plot, click once on the plot in either the plot window or the Object Manager to select it. The properties of the selected Q-Q plot are displayed in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

Labels

Symbol

Line

Graph Properties

The graph properties contain the following pages in the **Property Manager**.

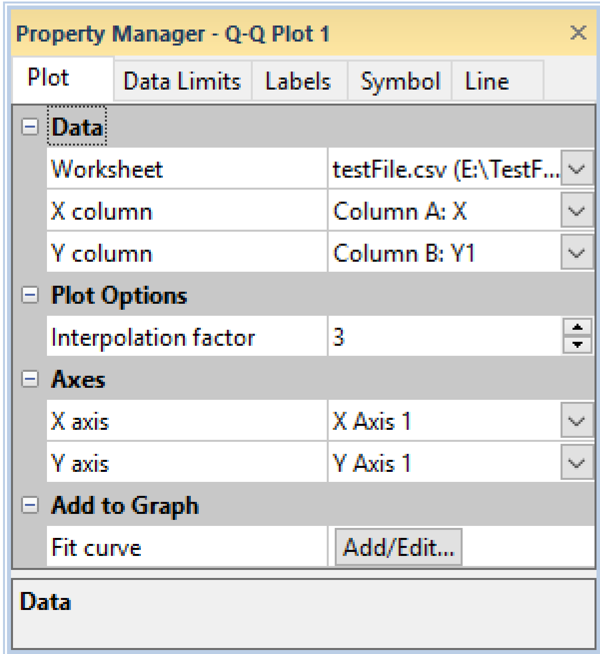
Title

Line

Fill

Plot Page - Q-Q and Normal Q-Q Plots

The Q-Q and normal Q-Q plot properties **Plot** page contains the options to change the data file and axes; set data used in the plot; set the interpolation factor; and create fit curves in the plot. To view and edit Q-Q plot properties, click on the Q-Q plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the Q-Q plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column* or *Y column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are three other options: row number, sequence number, and None. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* section. For example, if the first row is number two, the axis begins at a value of two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* group. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.
- *None* sets the column to the normal distribution. To compare a single data column against a normal distribution, select *None* for one of the columns.

When changing the *X column, Y column,* or *Z column* to a date/time column from a numeric column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be checked to match the new data. When changing the *X column, Y column,* or *Z column* to a numeric column from a date/time column, the *Use date/time format* option for the corresponding axis Tick Labels will automatically be unchecked to match the new data.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Interpolation Factor

The *Interpolation factor* controls the degree of the polynomial fit used to calculate the percentiles for the data points. This is used when the two data sets being compared contain a different number of unique points. The larger the *Interpolation factor* is, the more variation in the curve required to fit the data. Normally, a smaller value, such as the default 3, will give a closer match of where each point in the data set should be plotted and will give a better estimate of the actual percentile value. Values range from 1 to 10. To change the value, highlight the existing value and type the desired value. Alternatively, click the  buttons to increase or decrease the value. Press ENTER on the keyboard to make the change.

Change Axes

Click on the axis name next to the *X axis*, or *Y axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, or *Y axis* lists.

Fits

Click the **Home | Add to Graph | Fit Curve** command to add a fit curve to the graph. This adds a linear fit by default. Many fit types are available.

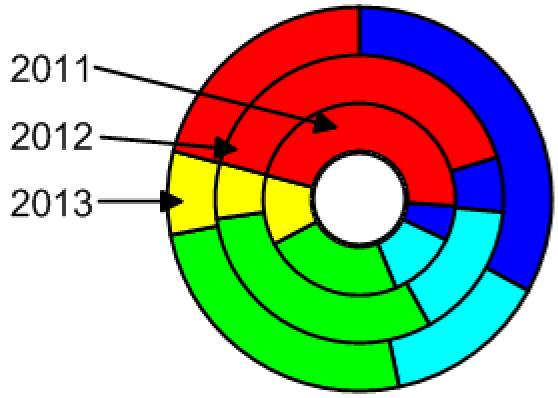
Doughnut Plots

Click the **Home | New Graph | Statistical | Doughnut Plot** command to display data as proportional slices of a circle with a hole in the center. Each data value is divided by the sum of all the data to determine the size of the slice. The data with the largest proportions appear as the largest slices.

*Click the **Doughnut Plot** button to create a doughnut plot.*

Doughnut plots differ from pie charts in that multiple doughnut plots can be overlaid, allowing a layered look of the pie charts. This allows multiple groups of data to be quickly compared.

After being created, doughnut plots contain each row as a separate slice of the doughnut. The doughnut plot is automatically labeled with two labels. The top label is the text in the worksheet's label column. The second label is the percentage of the doughnut for that slice. Either label can be altered to display data value, as well.



Doughnut plots show data as proportions of a circle. Stacked doughnut plots show multiple groups of the same relative data layered to aid in comparison.

Creating a New Doughnut Plot

To create a doughnut plot:

1. Click the **Home | New Graph | Statistical | Doughnut Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A doughnut plot is created using the default properties.

Editing Doughnut Plot Properties

To change the features of a doughnut plot - including the columns used to create the plot - first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot
Slices
Title
Labels
Line
Fill

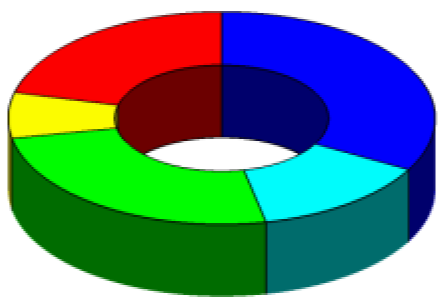
3D Doughnut Plots

Click the **Home | New Graph | Statistical | 3D Doughnut Plot** command to display data as proportional slices of a disk or torus. Each data value is divided by the sum of all the data to determine the size of the slice. The data with the largest proportions appear as the largest slices.

*Click the **3D Doughnut Plot** button to create the doughnut plot with a 3D appearance.*

The inner hole can be resized and the shape of the doughnut can be altered.

After being created, 3D doughnut plots contain each row as a separate slice of the doughnut. The doughnut plot is automatically labeled with two labels. The top label is the text in the worksheet's label column. The second label is the percentage of the doughnut for that slice. Either label can be altered to display data value, as well.



3D doughnut plots are doughnut plots with an added depth option.

Creating a New 3D Doughnut Plot

To create a 3D doughnut plot:

1. Click the **Graphs | Create | Statistical | 3D Doughnut Plot** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A 3D doughnut plot is created using the default properties.

Editing 3D Doughnut Plot Properties

To change the features of a 3D doughnut plot - including the columns used to create the plot - first select the plot in the plot window or Object Manager and then edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Slices

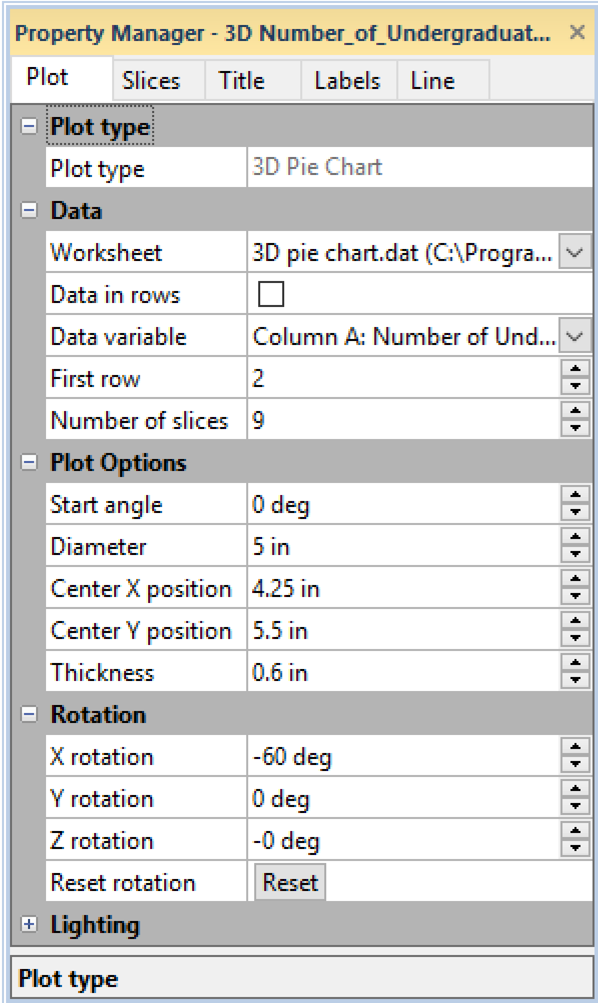
Title

Labels

Line

Plot Page - Pie and Doughnut Charts

The pie chart properties **Plot** page contains the options to change the data file, set data used in the plot, and edit the number of slices. To view and edit pie chart properties, click on the pie chart in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Change the pie chart properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click

on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Data in Rows

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *Data column* field to change the column used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter. The *Data column* is the column being displayed as the slice.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Limiting the Data

Choose the range of rows to plot in a pie chart. The default rows are the first and last rows containing data.

To limit the range of the plotted data, you can change the range of rows. The *First row* is the worksheet row value for the first row to be included as a slice in the pie chart. The *Number of slices* option lists how many slices should be included in the pie chart. To limit the range of the plotted data, you can change the range of rows. Highlight the existing value in either the *First row* or *Number of slices* boxes. Type a new value or click the  to scroll to a new value. Press ENTER on the keyboard to update the pie chart. The *Number of slices* must be an integer between 1 and 200. No more than 200 slices can be displayed on a pie chart at one time.

When changing the *Data column* or *Worksheet*, the *Number of slices* automatically updates to include all of the rows containing data for the new worksheet or column.

Start Angle

The *Start angle* option lets you rotate the pie chart by a fixed number of degrees. Zero degrees points directly up on the pie chart. The first data value is drawn with the left edge of the slice on the vertical line and the right edge is drawn clockwise from this line. Entering positive numbers in the *Start angle* rotates the pie clockwise. Entering negative numbers in the *Start angle* rotates the pie counterclockwise. To change the *Start angle*, highlight the existing value and type a new value. Alternatively, click the to increase or decrease the angle. Press ENTER on the keyboard to update the pie chart.

Diameter

The *Diameter* option controls the size of the pie chart. By default, a new pie chart or 3D pie chart is 5.00 inches in width, not including any labels that extend outside the pie circle or exploded pie slices. To change the size of the pie chart, highlight the existing value and type a new value. Press ENTER on the keyboard to update the pie chart. Alternatively, click the to increase or decrease the pie chart size. The size of the pie chart is in page units and can be set to any value from -200 to +200 inches.

The pie chart can also be resized by clicking on the bounding box and dragging the size. When the pie chart contains exploded pieces, dragging the size could result in a non-circular area. In this case, the size should be set with the *Diameter* option.

Center X Position

The *Center X position* option controls the location of the pie chart in the horizontal direction. The position controls the center location of the pie chart where all of the pie pieces touch. To change the pie chart location, highlight the existing value and type the desired value. Alternatively, click the to increase or decrease the value. Pie charts can also be moved by clicking and dragging the pie chart to the desired location. The position is in page units and can be set to any value from -100 to +100 inches.

Center Y Position

The *Center Y position* option controls the location of the pie chart in the vertical direction. The position controls the center location of the pie chart where all of the pie pieces touch. To change the pie chart location, highlight the existing value and type the desired value. Alternatively, click the to increase or decrease the value. Pie charts can also be moved by clicking and dragging the pie chart to the desired location. The position is in page units and can be set to any value from -100 to +100 inches.

Thickness

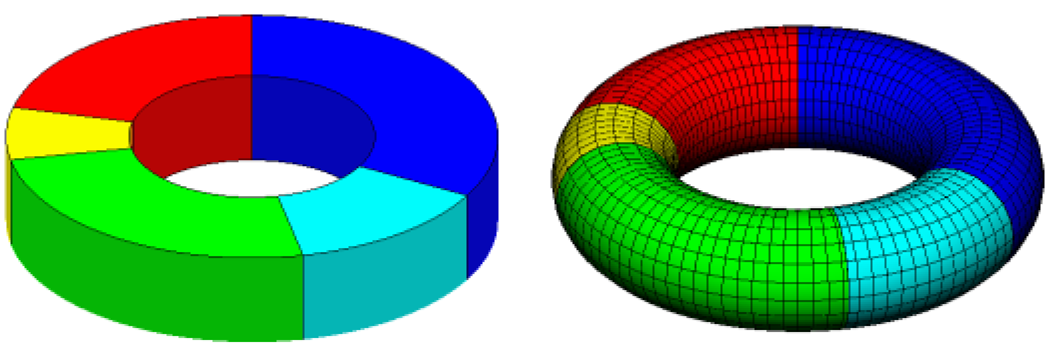
The *Thickness* option is available for 3D pie charts. The *Thickness* determines how thick the 3D pie chart is displayed. To change the *Thickness,* highlight the existing value and type a new value. Alternatively, click the  to increase or decrease the thickness. Press ENTER on the keyboard to update the pie chart. The *Thickness*is in page units and can be set between 0 and 6 inches (0.0 and 15.24 centimeters).

Hole Size

The *Hole size* controls how large the center hole is with respect to the entire doughnut plot. The value is a percentage, varying from 0% to 95%. The larger the value, the larger the hole in the center of the doughnut plot. To change the value, highlight the existing value and type a new value. Press ENTER on the keyboard to update the plot. Alternatively, click the  to increase or decrease the size of the hole.

Shape

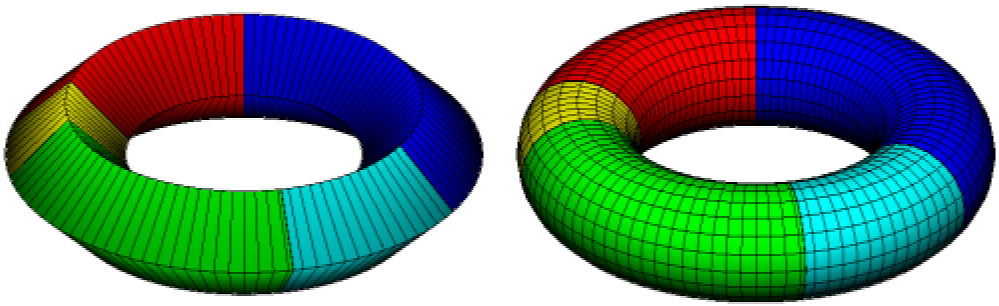
The *Shape* option is available for 3D doughnut plots. The *Shape* controls the how the 3D object is drawn. To change the *Shape*, click on the existing option and select the desired option from the list. Available options are *Torus* and *Disk*. When *Torus* is selected, the *Number of sides* and *Number of segments* options are also available.



The two plots display the same data. The doughnut plot displays the disk shape. The doughnut plot on the right displays the torus shape.

Number of Sides

The *Number of sides* option is available for 3D doughnut plots when the *Shape* is set to *Torus*. The *Number of sides* controls how smooth the rounding is on the torus. To change the *Number of sides*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the number of sides. The value can be from 2 to 100. The default is 20 sides.

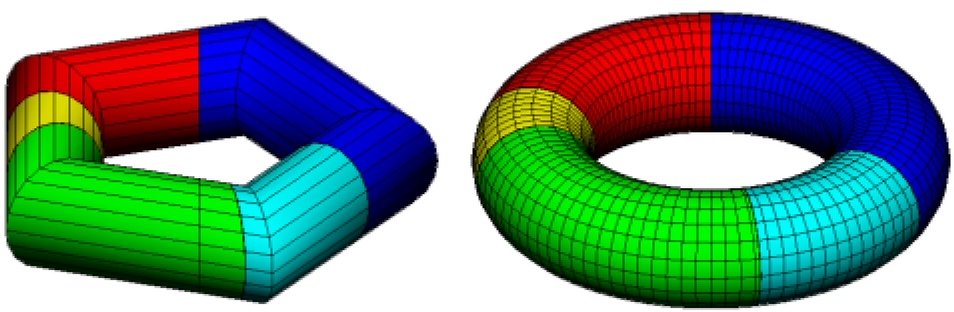


The two plots display the same data. The doughnut plot on the left contains

four sides. The doughnut plot on the right contains 20 sides.

Number of Segments

The *Number of segments* option is available for 3D doughnut plots when the *Shape* is set to *Torus*. The *Number of segments* controls how circular the ring is for the torus. To change the *Number of sides*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the number of sides. The value can be from 3 to 200. The default is 100 segments.



The two plots display the same data. The doughnut plot on the left contains

five segments. The doughnut plot on the right contains 100 segments.

Slices

Information about each pie slice is listed in the Slices dialog. You can set properties for each slice, such as fill color or explosion factor, in the **Slices** dialog. You can also set properties for all slices at once, for example applying a colormap to the fill colors or set the line properties. Click the *Edit*button next to the *Slices* command to edit the pie chart slice properties.

Rotation

3D plots can be rotated around X, Y, and Z axes. You can set the rotation in the *X rotation*, *Y rotation*, and *Z rotation* boxes. Positive values rotate to the left. Negative values rotate to the right. The rotation is measured in degrees from -360 to 360. To change the rotation, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the  to increase or decrease the value.

Occasionally the *X rotation*, *Y rotation*, and *Z rotation* values will update when you make a large change to one of the rotation values, deselect the object, and select the object again. Although the rotation values change the object orientation will remain the same.

Reset Rotation

Click the *Reset* button next to the *Reset position* command to reset the rotation to the **Grapher** defaults. You can also use the **Layout | Rotate | Reset Rotation** command to reset the rotation.

Rotation Tip

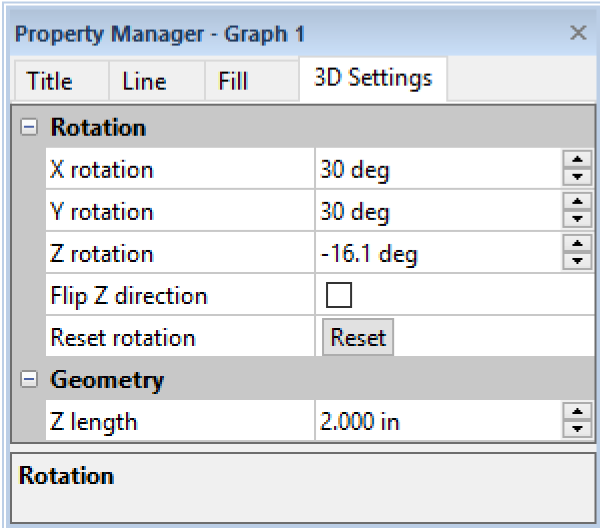
To set the rotation of a graph, click the Layout | Rotate | Custom Angle or the Layout | Rotate | Free Rotate command.

Lighting

The *Lighting* section of the **Plot** page includes the 3D lighting properties.

3D Settings - Graph Objects

The *3D Settings* properties control the rotation and depth of a 3D graph. These properties are opened by selecting a graph and then opening the *3D Settings* section in the Property Manager by clicking on the **3D Settings** tab. For 3D pie charts or 3D doughnut plots, click on the plot and click the **Plot** tab.



*To change the 3D aspects of the graph, click on the **3D Settings** tab in the **Property Manager**.*

Rotation

3D plots can be rotated around X, Y, and Z axes. You can set the rotation in the *X rotation*, *Y rotation*, and *Z rotation* boxes. Positive values rotate to the left. Negative values rotate to the right. The rotation is measured in degrees from -360 to 360. To change the rotation, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the  to increase or decrease the value.

Occasionally the *X rotation*, *Y rotation*, and *Z rotation* values will update when you make a large change to one of the rotation values, deselect the object, and select the object again. Although the rotation values change the object orientation will remain the same.

Rotation Tip

To set the rotation of a graph, click the Layout | Rotate | Custom Angle or the Layout | Rotate | Free Rotate command.

Flip Z Direction

The *Flip Z direction* option appears only if the 3D rotation function is used, i.e. the *3D rotation* box is checked on the *Plots* page in the File | Options dialog. Having this box checked is the default. Check the *Flip Z direction* box to flip the Z axis direction. This option is not available for pie charts or doughnut plots.

When the Flip Z direction option is cleared, the default setting, the coordinate system is left-handed. The positive X, Y, and Z axes point right, up, and in to the screen respectively and positive rotation is clockwise about the axis of rotation. When the *Flip Z direction* option is selected, the coordinate system is right-handed. The positive X, Y, and Z axes point right, up, and out of the screen respectively and positive rotation is counterclockwise about the axis of rotation.

Enable Z Rotation

The *Enable Z rotation* option appears only if the 3D rotation function is not used, i.e., the *3D rotation* box is unchecked on the *Plots* page in the File | Options dialog. When the *Enable Z rotation* box is checked, the *Z rotation* can be manually adjusted. When the *Enable Z rotation* box is not checked, the Z rotation is automatically adjusted to keep the Y axis vertical.

Z Length

The *Z Length* field controls the axis depth of the 3D graph. The depth is measured in page units and must be a value between 0 and 6 inches (0 and 15.24 centimeters). To change the *Z Length*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the  to increase or decrease the value.

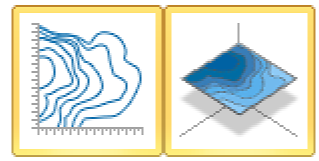
For true 3D plots, such as 3D XYZ plots, the *Z length* and Z axis *Length* values must be equal. Changing either the graph's *Z length* property or Z axis' *Length* property automatically updates the other. Note that with 3D pie charts and 3D doughnut plots, the depth is controlled through the *Thickness* and *Diameter* options in the Plot plage.

Reset

Click the *Reset*button next to the *Reset position* command to reset the rotation to the **Grapher** defaults. You can also use the **Layout | Rotate | Reset Rotation** command to reset the rotation.

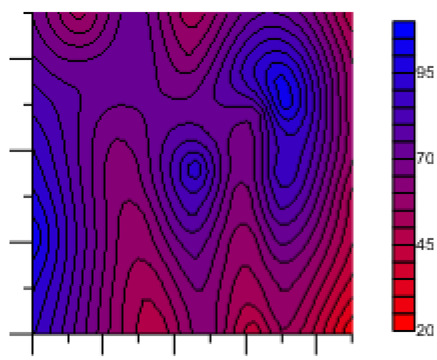
Contour Data Map

Click the **Home | New Graph | Contour Surface | XY Contour Data Map** or **Home | New Graph | Contour Surface | XZ Contour Data Map** command to create a contour map from a data file (such as a .DAT or .XLS file). Data is gridded using the inverse distance algorithm.



Click the ***XY Contour Data Map*** *or* ***XZ Contour Data Map*** *buttons to create contour maps from data files.*

A contour map is a two-dimensional representation of three-dimensional data. Two types of contour data maps may be created: XY data maps and XZ data maps.



A contour data map is created from a data file of X, Y, and Z values.

XY Contour Data Map

The first two dimensions of the XY data map are the XY coordinates; the third dimension (Z) is represented by lines of equal value. The relative spacing of the contour lines indicates the relative slope of the surface. The area between two contour lines contains only grid nodes having Z values within the limits defined by the two enclosing contours. The difference between two contour lines is defined as the contour interval.

XZ Contour Data Map

The XZ contour data map uses the X and Z axes rather than the X and Y axes. The first two dimensions of the XZ data map are the XZ coordinates; the third dimension (Y) is represented by lines of equal value. The relative spacing of the contour lines indicates the relative slope of the surface. The area between two contour lines contains only grid nodes having

Y values within the limits defined by the two enclosing contours. The difference between two contour lines is defined as the contour interval.

An overlay control is available for XZ contour data maps. This feature allows you to overlay the XZ contour map on a surface data or surface grid map that is part of the graph. See Plot - Contour Data Maps for more information.

Creating a New Contour Data Map

To create a new contour data map:

1. Click the **Home | New Graph | Contour Surface | XY Contour Data Map** or **Home | New Graph | Contour Surface | XZ Contour Data Map** command.
2. Select a data file in the**Open Worksheet**dialog. You can select a new data file or you can select an open data file in the*Open worksheets*section.
3. A contour data map is created using the default properties.

Editing an Existing Contour Data Map

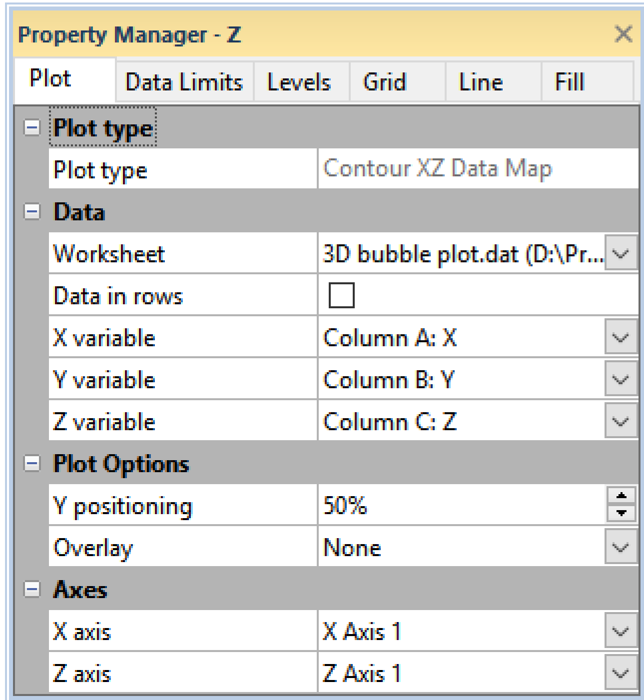
To change the features of the contour data map, select the contour data map and edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot
Data Limits
Levels
Grid
Line
Fill

Plot Page - Contour Data Maps

To view and edit contour data map plot properties, select the map and then click the **Plot** tab in the Property Manager. You can then change the data file, axes, and worksheet columns and rows; show or hide fill contours and color scales; configure blanking lines and fills; and set or reset levels in the contour data map.



Set the contour data properties in the ***Property Manager*** *on the* ***Plot*** *tab.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *Y column*, and *Z column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Y Positioning

On XZ contour data maps, the *Y positioning* adjusts the position of the XZ contour map on the Y axis. This number is expressed as a percentage of the total Y axis length, e.g., an entry of “50%” will position the XZ contour map about halfway up the Y axis. To change the *Y positioning*, highlight the existing value and type a new value or click the  to increase or decrease the value. Press ENTER on the keyboard to make the change.

Overlay

On XZ contour data maps, select a surface map from the list next to *Overlay* on which to overlay the XZ contour map. Note: the surface map must be part of the same graph as the XZ contour map. To change the *Overlay*, click on the existing option and select the new option from the list. All surface maps in the existing graph will be listed.

To overlay a contour map and surface map:

1. Create a contour map using the **Home | New Graph | Contour Surface | XZ Contour Data Map** or **Home | New Graph | Contour Surface | XZ Contour Grid Map** or **Home | New Graph | Contour Surface | XZ Contour Function Map** commands.
2. Add a surface map to the graph using the **Home | Add to Graph | Plot** command.
3. Select a *Surface Function Map, Surface Data Map,* or *Surface Grid Map* and click *OK*.

4. Select the axes and click *OK*.
5. Select the data file or grid file and click *Open*.
6. Click on the contour map in the **Object Manager** or plot window to select it.
7. In the **Property Manager**, click on the **Plot** tab. Change the *Overlay* to the surface map.
8. Click on the surface map in the **Object Manager** or plot window to select it.
9. In the **Property Manager**, click on the Plottab. Set any desired overlay properties.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

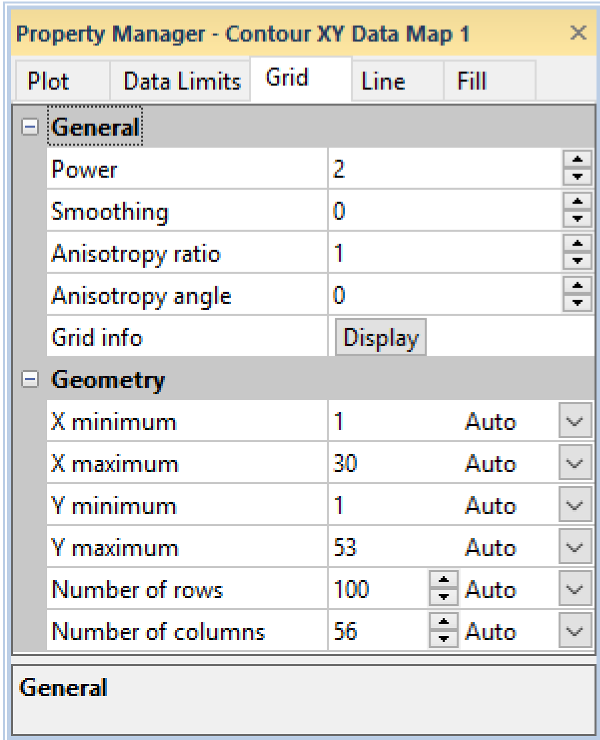
See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

NoData Line and Fill

The line properties for NoData regions are specified on the **Line** page in the *NoData Line Properties* section. The fill properties for NoData regions are specified on the **Fill** page in the *NoData Fill Properties* section.

Grid Properties - Contour Maps

The **Grid** tab is available for contour data maps and contour function maps. This page is used to set the factors used in the gridding calculation, including power, smoothing, anisotropy ratio and angle, minimum and maximum X and Y values, and number of rows and columns. The selected gridding properties appear in the Property Manager.



*Set the contour gridding options on the **Grid** tab in the**Property Manager**.*

Power

The *Power* is used to change the power used by the inverse to a distance gridding calculation. This value must be between 1e-013 and 20. To change the *Power*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Smoothing

The *Smoothing* is used to change the smoothing parameter used by the inverse distance to a power gridding calculation. This value must be between 0 and 9000. When the *Smoothing* value is zero, the grid goes through every data point. The larger the smoothing factor parameter, the less overwhelming influence any particular observation has in computing a neighboring grid node. To change the *Smoothing,* highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Anisotropy Ratio

The *Anisotropy ratio* is used to control the anisotropy used by the gridding calculation. The *Anisotropy ratio* is the maximum range divided by the minimum range. An anisotropy ratio less than two is considered mild, while an anisotropy ratio greater than four is considered severe. Typically, when the anisotropy ratio is greater than three the effect is clearly visible on grid-based maps. This value must be between 1e-10 and 1e+007. To change the *Anisotropy ratio,* highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Anisotropy Angle

The *Anisotropy angle* is used to change the angle used by the gridding calculation. The *Anisotropy angle* is the preferred orientation (direction) of the major axis in degrees. Positive *Anisotropy angles* rotate counter-clockwise. This value must be between -360 and 360. To change the *Anisotropy angle,* highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Grid Info

Click the *Display* button next to the *Grid info* command to view grid information.

X Values

The *X minimum* and *X maximum* values set the extents of the gridding in the X axis direction. Leave the *Auto* box checked next to one or both to have **Grapher** automatically set the X values. To change *X minimum* or *X maximum* values, click the word *Auto* and select *Custom*. You can then enter a new value into either the *X minimum* or *X maximum* boxes. To change the value, highlight the existing number and type a new value. Press ENTER on the keyboard to update the plot. Values are in X axis units.

Click the word *Custom* and select *Auto* to go back to automatic minimum and maximum values. The word*Auto*will appear and the*X minimum* or *X maximum* will revert to the default value.

Y Values

The *Y minimum* and *Y maximum* values set the extents of the gridding in the Y axis direction. Leave the *Auto* box checked next to one or both to have **Grapher** automatically set the Y values. To change *Y minimum* or *Y maximum* values, click the word *Auto* and select *Custom*. You can then enter a new value into either the *Y minimum* or *Y maximum* boxes. To change the value, highlight the existing number and type a new value. Press ENTER on the keyboard to update the plot. Values are in Y axis units.

Click the word *Custom* and select *Auto* to go back to automatic minimum and maximum values. The word*Auto*will appear and the Y*minimum* or *Ymaximum* will revert to the default value.

Number of Rows

The *Number of rows* sets the number of grid rows to be calculated. Leave the *Auto* box checked next to the number to have **Grapher** automatically set the number of rows. The larger the *Number of rows*, the more detailed and accurate the grid will be. It will also take longer to update the graph. To change the *Number of rows*, click the word *Auto* and select *Custom*. To change the value, highlight the existing number and type a new value. Press ENTER on the keyboard to update the plot. Alternatively, click the to increase or decrease the value.

Click the word *Custom* and select *Auto* to go back to the automatic number of rows. The word *Auto* will appear and the *Number of rows* will revert to the default value.

Number of Columns

The *Number of columns* sets the number of grid columns to be calculated. Leave the *Auto* box checked next to the number to have **Grapher** automatically set the number of columns. The larger the *Number of columns,* the more detailed and accurate the grid will be. It will also take longer to update the graph. To change the *Number of columns,* click the word *Auto* and select *Custom*. To change the value, highlight the existing number and type a new value. Press ENTER on the keyboard to update the plot. Alternatively, click the to increase or decrease the value.

Click the word *Custom* and select *Auto* to go back to the automatic number of columns. The word *Auto* will appear and the *Number of columns* will revert to the default value.

Inverse Distance to a Power

The *Inverse Distance to a Power* gridding method is a weighted average interpolator, and can be either an exact or a smoothing interpolator. **Grapher**automatically uses the *Inverse Distance to a Power* gridding method whenever a contour data map or surface data map is created.

With *Inverse Distance to a Power*, data are weighted during interpolation such that the influence of one point relative to another declines with distance from the grid node. Weighting is assigned to data through the use of a weighting power that controls how the weighting factors drop off as distance from a grid node increases. The greater the weighting power, the less effect points far from the grid node have during interpolation. As the power increases, the grid node value approaches the value of the nearest point. For a smaller power, the weights are more evenly distributed among the neighboring data points.

Normally, *Inverse Distance to a Power* behaves as an exact interpolator. When calculating a grid node, the weights assigned to the data points are fractions, and the sum of all the weights are equal to 1.0. When a particular observation is coincident with a grid node, the distance between that observation and the grid node is 0.0, and that observation is given a weight of 1.0, while all other observations are given weights of 0.0. Thus, the grid node is assigned the value of the coincident observation. The Smoothing parameter is a mechanism for buffering this behavior. When you assign a non-zero Smoothing parameter, no point is given an overwhelming weight so that no point is given a weighting factor equal to 1.0. You can adjust the smoothing used by *Inverse Distance to a Power* in the *Gridding* section of contour data map or surface data map properties. See Grid Properties - Contour Maps or Grid Properties - Surface Maps for more information.

One of the characteristics of *Inverse Distance to a Power* is the generation of "bull's-eyes" surrounding the position of observations within the gridded area. Adjusting the power used by the *Inverse Distance to a Power* feature reduces the "bull's-eye" effect by smoothing the interpolated grid.

Inverse Distance to a Power Math

The equation used for *Inverse Distance to a Power* is:

$$\hat{C}_j = \frac{\sum_{i=1}^{n} \frac{C_i}{h_{ij}^{\beta}}}{\sum_{i=1}^{n} \frac{1}{h_{ij}^{\beta}}}$$

$$h_{ij} = \sqrt{d_{ij}^2 + \delta^2}$$

where:

h_{ij}	is the effective separation difference between grid node "j" and neighboring point "i";
$\hat{C}_j$	is the interpolated value for grid node "j";

C_i are the neighboring points;
d_{ij} is the difference between grid node "j" and neighboring point "i";
β is the weighting power (the *Power*parameter); and
δ is the *Smoothing*parameter.

Inverse Distance to a Power References

Davis, John C. (1986), Statistics and Data Analysis in Geology, John Wiley and Sons, New York.

Franke, R. (1982), Scattered Data Interpolation: Test of Some Methods, Mathematics of Computations, v. 33, n. 157, p. 181-200.

Producing a Surface or Contour Map from a Regular Array of XYZ Data

When your XYZ data are collected or generated on regular intervals it is possible to produce a grid file that uses your values directly and does not interpolate the values for the grid nodes. You can create a surface data map or contour data map to create a contour or surface map from the data.

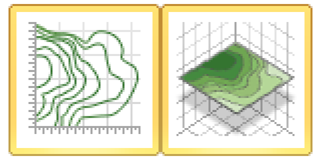
To produce a surface or contour map from regularly spaced data:

1. Create an XYZ data .DAT file from your data. All X values must be in one column, Y values in another column, and Z values in a third column.
2. Click the **Home | New Graph | Contour/Surface | XY Contour Data Map**, **Home | New Graph | Contour/Surface | XZ Contour Data Map**, or **Home | New Graph | Contour/Surface | Surface Data Map** command.
3. Specify the name of the XYZ data file in the **Open Worksheet** dialog and click *Open*.
4. In the **Property Manager**, click on the Gridding tab.
5. Set the *Number of rows* and *Number of columns* to match the spacing of your data in the X and Y directions. This assures that the grid nodes coincide with your data. For example, if your data are separated by 100 meters over the extent of your map, enter 100 for both options and the grid file is created.

You can also produce grid files directly from an evenly spaced array of Z values. When your Z values are organized correctly in an ASCII file, you can add some header information identifying the data as a grid file, specify the limits of the data, and then save the file. The ASCII grid file format is given in Surfer 6 Text Grid Format.

Contour Grid Map

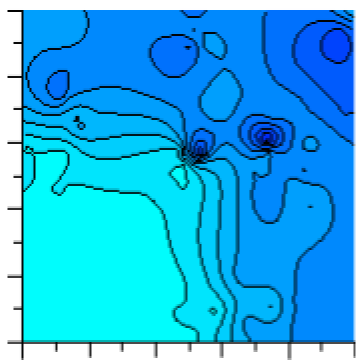
Click the **Home | New Graph | Contour Surface | XY Contour Grid Map** or **Home | New Graph | Contour Surface | XZ Contour Grid Map** command to create a contour map from a grid file. Contour grid maps are created from grid files, types of which include .GRD, .DEM, .DDF, .HDR, and .DTED.



*Click the **XY Contour Grid Map** or **XZ Contour Grid Map** buttons to create contour maps from grid files.*

If your data is in a regular array of Z values, you may convert it to an ASCII .GRD file format.

A contour map is a two-dimensional representation of three-dimensional data. Two types of contour grid maps may be created: XY grid maps and XZ grid maps.



A contour grid map is created from a grid file.

XY Contour Grid Map

The first two dimensions of the XY grid map are the XY coordinates; the third dimension (Z) is represented by lines of equal value. The relative spacing of the contour lines indicates the relative slope of the surface. The area between two contour lines contains only grid nodes having Z values within the limits defined by the two enclosing contours. The difference between two contour lines is defined as the contour interval.

XZ Contour Grid Map

The XZ contour grid map uses the X and Z axes rather than the X and Y axes. The first two dimensions of the XZ grid map are the XZ coordinates; the third dimension (Y) is represented by lines of equal value. The relative spacing of the contour lines indicates the relative slope of the surface. The area between two contour lines contains only grid nodes having Y values within the limits defined by the two enclosing contours. The difference between two contour lines is defined as the contour interval.

An overlay control is available for XZ contour grid maps. This feature allows you to overlay the XZ contour map on a surface data or surface grid map that is part of the graph. See Plot - Contour Grid Maps for more information.

Creating a New Contour Grid Map

To create a new contour grid map:

1. Click the **Home | New Graph | Contour Surface | XY Contour Grid Map** or **Home | New Graph | Contour Surface | XZ Contour Grid Map** command.
2. Select a data file in the **Open Grid** dialog. You can select a new grid file or you can select an open grid file in the *Open grids* section.
3. A contour grid map is created using the default properties.

Editing an Existing Contour Grid Map

To change the features of the contour grid map, select the contour grid map and edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

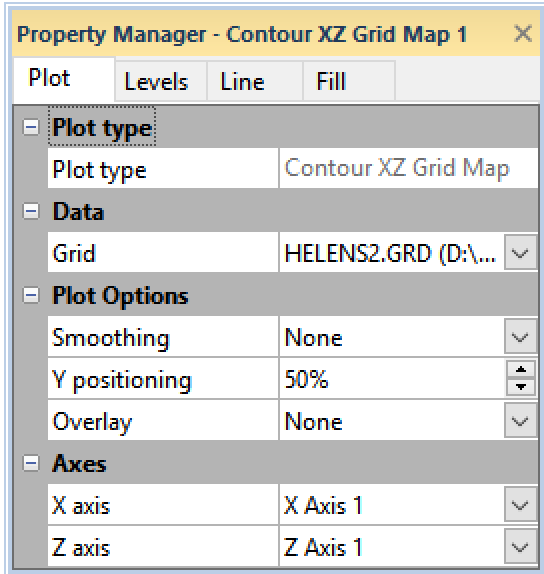
Levels

Line

Fill

Plot Page - Contour Grid Maps

To view and edit contour data map plot properties, select the map and then click the **Plot** tab in the Property Manager. You can then change the data file, axes, and worksheet columns and rows; show or hide fill contours and color scales; configure blanking lines and fills; and set or reset levels in the contour grid map.



Set the contour data properties in the ***Property Manager****on the****Plot****tab.*

Plot Type

The *Plot type* property displays the type of plot.

Grid

Click the existing grid file path and file name next to *Grid* to select a different grid file for the plot. Click on a currently open grid file or click the *Browse* option to navigate to a grid file that is not yet open. Select a different grid file in the**Open Worksheet**dialog, and click the*Open*button to change the data. The plot automatically updates.

Smoothing

The *Smoothing* option applies a smoothing algorithm to the contour lines. To change the *Smoothing*option, click on the existing option and select a new one from the list. Available options are *Low*, *Medium* and *High*. The more smoothing that is applied, the more likely that contour lines could cross or be located incorrectly based on the gridded values.

Y Positioning

On XZ contour grid maps, the *Y positioning* adjusts the position of the XZ contour map on the Y axis. This number is expressed as a percentage of the total Y axis length, e.g., an entry of “50%” will position the XZ contour map about halfway up the Y axis. To change the *Y positioning*, highlight the existing value and type a new value or click the to increase or decrease the value. Press ENTER on the keyboard to make the change.

Overlay

On XZ contour grid maps, select a surface map from the list next to *Overlay* on which to overlay the XZ contour map. Note: the surface map must be part of the same graph as the XZ contour map. To change the *Overlay*, click on the existing option and select the new option from the list. All surface maps in the existing graph will be listed.

To overlay a contour map and surface map:

1. Create a contour map using the **Home | New Graph | Contour Surface | XZ Contour Data Map** or **Home | New Graph | Contour Surface | XZ Contour Grid Map** or **Home | New Graph | Contour Surface | XZ Contour Function Map** commands.
2. Add a surface map to the graph using the **Home | Add to Graph | Plot** command.
3. Select a *Surface Function Map, Surface Data Map,* or *Surface Grid Map* and click *OK*.
4. Select the axes and click *OK*.
5. Select the data file or grid file and click *Open*.
6. Click on the contour map in the **Object Manager** or plot window to select it.
7. In the **Property Manager**, click on the **Plot** tab. Change the *Overlay* to the surface map.
8. Click on the surface map in the **Object Manager** or plot window to select it.
9. In the **Property Manager**, click on the**Plot** tab. Set any desired overlay properties.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

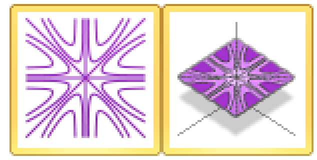
See the [Axis - Add to Graph](#) page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

NoData Line and Fill

The [line properties](#) for NoData regions are specified on the **Line** page in the *NoData Line Properties* section. The [fill properties](#) for NoData regions are specified on the **Fill** page in the *NoData Fill Properties* section.

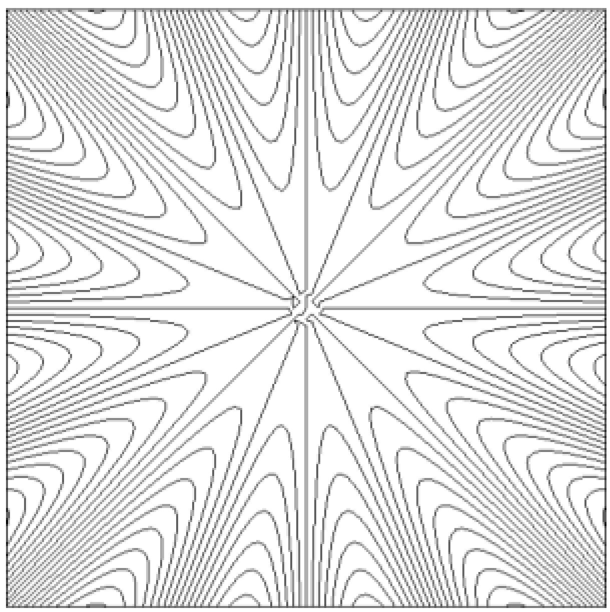
Contour Function Map

Click the **Home | New Graph | Contour Surface | XY Contour Function Map** or **Home | New Graph | Contour Surface | XZ Contour Function Map** command to create a contour map from a mathematical equation.



Click the **XY Contour Function Map** *or* **XZ Contour Function Map** *buttons to create contour maps from mathematical functions.*

A contour map is a two-dimensional representation of three-dimensional data. Two types of contour function maps may be created: XY function maps and XZ function maps.



A contour function map is created from a mathematical equation.

XY Contour Function Map

The first two dimensions of the XY function map are the XY coordinates; the third dimension (Z) is represented by lines of equal value. The relative spacing of the contour lines indicates the relative slope of the surface. The area between two contour lines contains only grid nodes having Z values within the limits defined by the two enclosing contours. The difference between two contour lines is defined as the contour interval.

XZ Contour Function Map

The XZ contour function map uses the X and Z axes rather than the X and Y axes. The first two dimensions of the XZ function map are the XZ coordinates; the third dimension (Y) is represented by lines of equal value. The relative spacing of the contour lines indicates the relative slope of the surface. The area between two contour lines contains only grid nodes having Y values within the limits defined by the two enclosing contours. The difference between two contour lines is defined as the contour interval.

An overlay control is available for XZ contour function maps. This feature allows you to overlay the XZ contour map on a surface data or surface grid map that is part of the graph. See Plot - Contour Function Maps for more information.

Creating a New Contour Function Map

To create a new contour function map:

1. Click the **Home | New Graph | Contour Surface | XY Contour Function Map** or **Home | New Graph | Contour Surface | XZ Contour Function Map** command.
2. A contour function map is created using the default properties.

Editing an Existing Contour Function Map

To change the features of the contour function map, select the contour function map and edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

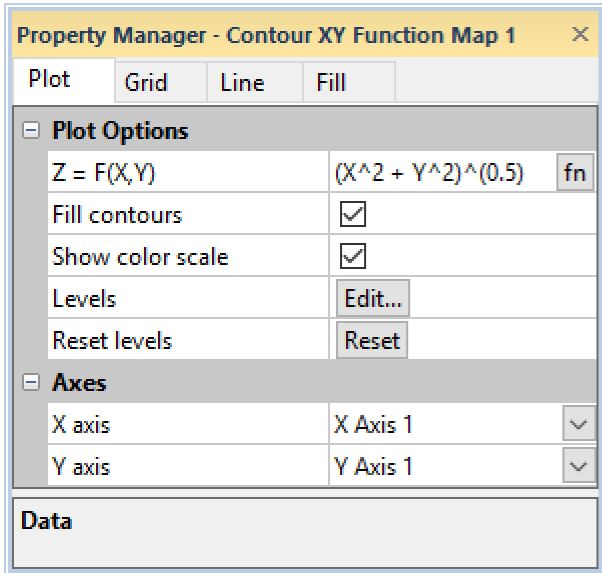
Grid

Line

Fill

Plot Page - Contour Function Maps

To view and edit contour function map plot properties, select the map and then click the **Plot** tab in the Property Manager . You can then change the function, axes, and worksheet columns and rows; show or hide fill contours and color scales; configure blanking lines and fills; and set or reset levels in the contour function map.



Set the contour data properties in the ***Property Manager*** *on the* ***Plot*** *tab.*

Plot Type

The *Plot type* property displays the type of plot.

Set Equation for Y

For an XZ contour function map, select the text next to *Y = F(X,Z) =* to change the function being plotted for Y. Click the fn button to open the Functions dialog and add predefined mathematical equations to the function, or type functions into the field manually. Press ENTER on the keyboard to make the change.

Set Equation for Z

For an XY contour function map, select the text next to *Z = F(X,Y) =* to change the function being plotted for Z. Click the fn button to open the Functions dialog and add predefined mathematical equations to the function, or type functions into the field manually. Press ENTER on the keyboard to make the change.

Fill Contours

Check the box next to the *Fill contours* command to draw the contour map with filled areas between the contour lines. Set the fill colors with the *Levels* command.

Show Color Scale

Check the box next to the *Show color scale* command to show the contour map's color scale. Note: this option is disabled if the *Fill contours* box is not checked.

Levels

The *Levels* command controls the number of lines and the color fill between contour lines. Click the *Edit* button to open the Levels dialog.

Reset

Click the *Reset* button next to the *Reset levels* command to reset levels to the default settings.

Y Positioning

On XZ contour function maps, the *Y positioning* adjusts the position of the XZ contour map on the Y axis. This number is expressed as a percentage of the total Y axis length, e.g., an entry of "50%" will position the XZ contour map about halfway up the Y axis. To change the *Y positioning*, highlight the existing value and type a new value or click the  to increase or decrease the value. Press ENTER on the keyboard to make the change.

Overlay

On XZ contour function maps, select a surface map from the list next to *Overlay* on which to overlay the XZ contour map. Note: the surface map must be part of the same graph as the XZ contour map. To change the *Overlay*, click on the existing option and select the new option from the list. All surface maps in the existing graph will be listed.

To overlay a contour map and surface map:

1. Create a contour map using the **Home | New Graph | Contour Surface | XZ Contour Data Map** or **Home | New Graph | Contour Surface | XZ Contour Grid Map** or **Home | New Graph | Contour Surface | XZ Contour Function Map** commands.
2. Add a surface map to the graph using the **Home | Add to Graph | Plot** command.
3. Select a *Surface Function Map, Surface Data Map,* or *Surface Grid Map* and click *OK*.

4. Select the axes and click *OK*.
5. Select the data file or grid file and click *Open*.
6. Click on the contour map in the **Object Manager** or plot window to select it.
7. In the **Property Manager**, click on the **Plot** tab. Change the *Overlay* to the surface map.
8. Click on the surface map in the **Object Manager** or plot window to select it.
9. In the **Property Manager**, click on the**Overlays**tab. Set any desired overlay properties.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

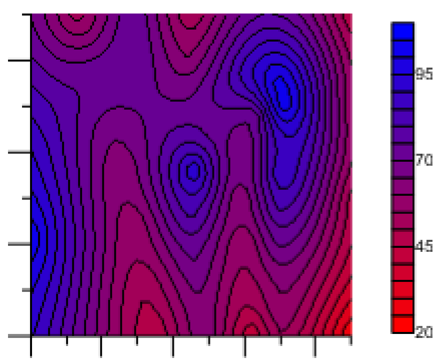
See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

NoData Line and Fill

The line properties for NoData regions are specified on the **Line** page in the *NoData Line Properties* section. The fill properties for NoData regions are specified on the **Fill** page in the *NoData Fill Properties* section.

Color Scale - Contour Maps

A color scale is a legend that shows the colors used in a contour map.



This contour map has a color scale to display the Z value of the colors.

Adding a Color Scale

To add a color scale to a contour map, first select the contour map in the Object Manager or plot window. In the Property Manager, click the **Plot** tab. Check the box next to the *Fill contours* command. Finally, check the box next to the *Show color scale* command to create the color scale. The color scale appears next to the contour map in the plot window.

Removing a Color Scale

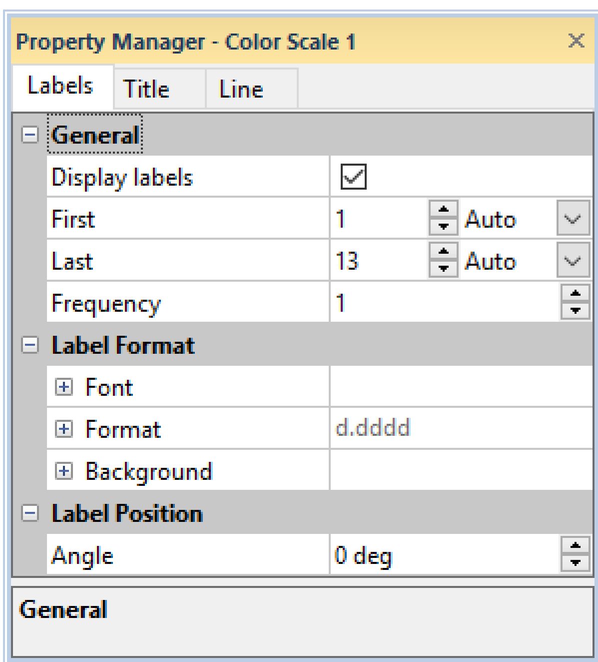
To remove a color scale, click on the contour map to select it. In the **Property Manager**, click on the **Plot** tab. Uncheck the box next to the *Show color scale* command.

Adding and Editing a Title

Click the **Title** tab to add a title and edit the title properties.

Editing a Color Scale

To modify the color scale, click on the color scale in the **Object Manager** or plot window. The properties for the color scale are displayed in the **Property Manager**. Click the **Labels** tab to access the color scale's label properties. There are three tabs: **Labels**, Title, and Line. The **Labels** tab options are described below.



Set the color scale bar properties on the ***Labels*** *tab in the* ***Property Manager****.*

Display Labels

Check the box next to the *Display labels* command to turn the scale labels on or off.

Label Range

The *First* and *Last* values define the contour interval for the first and last labels on the color scale. The values for the *First* and *Last* are incremental where 1 is the first line at the bottom of the color scale, 2 is the next line, 3 the third line, etc.

If *Auto* is selected for the *First* and *Last,* **Grapher** automatically determines the first and last value that is labeled for the color scale. To limit the range of labels, click the word *Auto* and select *Custom*. You can then enter a new value into either the *First* or *Last* boxes. To change the value, highlight the existing value and type a new value. Press ENTER on the keyboard to update the plot.

Click the word *Custom* and select *Auto* to go back to automatic values. The word *Auto* will appear and the *First* or *Last* will revert to the default values.

Use the *Frequency* to skip labels in the color scale. For example, if *Frequency* is set to five, every fifth line contains a label between the *First* and *Last* plotted labels. When *Frequency* is set to one, every data line on the color scale is labeled. To change the step, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Label Font

Click the next to *Font* to set the label font properties. The font *Face, Size (points), Color, Opacity, Bold, Italic, Underline,* and *Strikethrough* properties can be set for most labels.

Label Format

Click the next to *Format* to set the label format properties. The label *Type,* display of numbers, *Prefix,* and *Suffix* can be set for labels.

Label Background

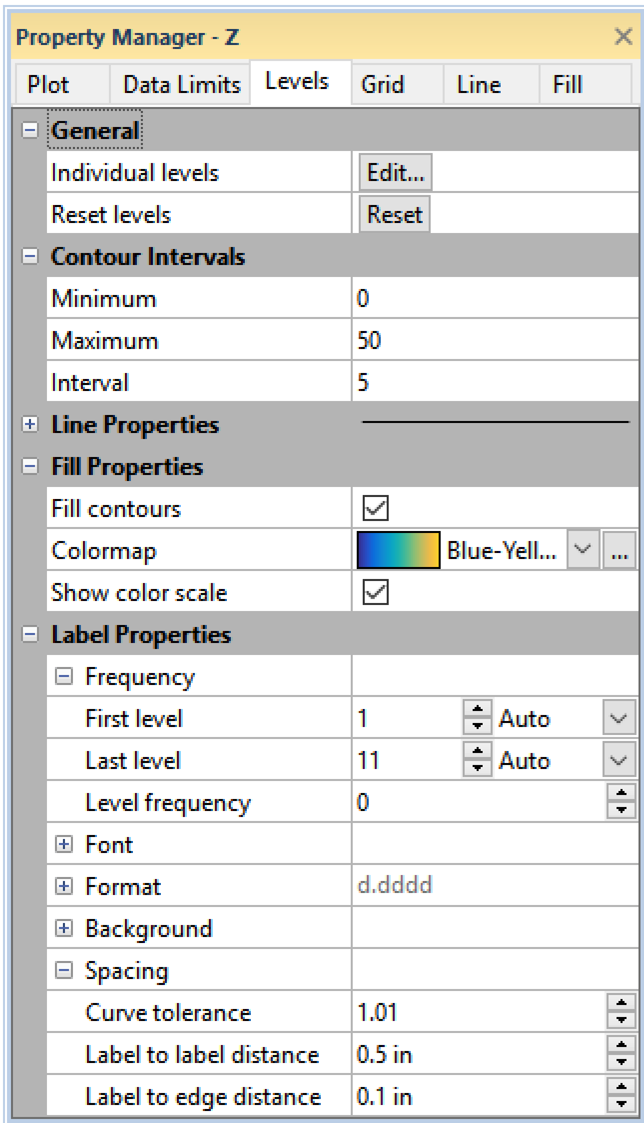
Click the next to *Background* to set the label background properties. The *Background* is the area behind the label. Click the next to *Line* to set the line properties for the line that goes around the text. Click the next to *Fill* to set the fill properties for the area around the text.

Label Angle

You can enter a number into the *Angle* box to rotate the labels. Positive values rotate the label in a counter-clockwise direction. The *Angle* is specified in degrees. To enter an angle, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the value.

Levels - Contour Maps

The **Levels** page in the [Property Manager] includes the levels properties for a [contour map].



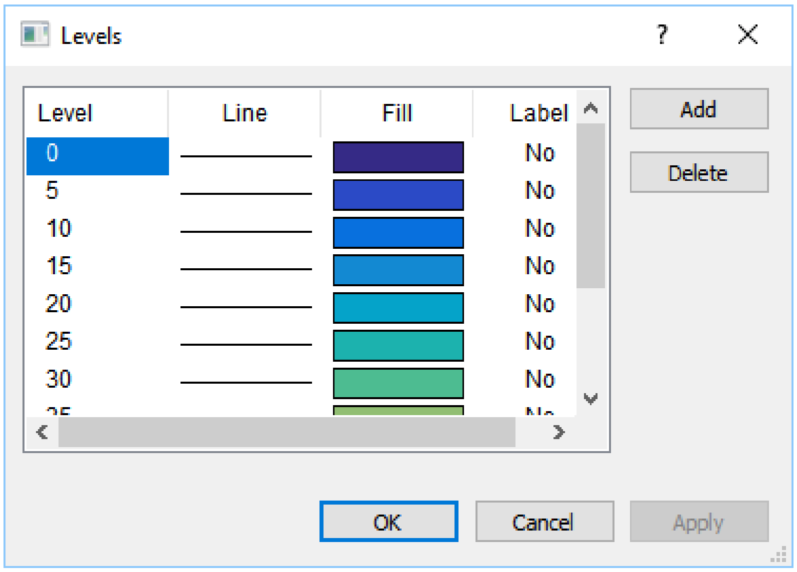
Set the contour level properties in the ***Levels*** *page.*

General

The *General* section includes properties for setting individual levels properties and returning the levels to default. Click *Edit* in the *Individual levels* field to edit individual levels in the **Levels** dialog. Click *Reset* in the *Reset levels* field to return the levels to their default properties.

Levels Dialog

The **Levels** dialog controls the display of individual contours, contour lines, and color fills on the contour map. The contour level list shows the contour levels to be displayed on the map.



*Use the **Levels** dialog to control the display of contour levels, line, and fill properties.*

Double-click any of the elements in the list to set parameters for a specific contour level.

- Double-click an individual level value to open the Set Level dialog.
- Double-click an individual line sample or fill color box to open the line and fill properties in the **Line/Fill Properties** dialog.
- Double-click and individual level label setting to toggle the label display on (*Yes*) or off (*No*).

Add

Click the *Add* button to open the **Set Level** dialog. You can define a new level and the level is added to the **Levels** dialog in the appropriate position.

Delete

Click the *Delete* buttons to delete the currently selected contour level.

Contour Intervals

The Contour Intervals section includes properties for quickly setting the contour level range and interval.

Minimum and Maximum

Enter values for the *Minimum* and *Maximum* contours in the *Contour Intervals* section. To change the value, highlight the existing value and type a new value.

Interval

Enter an *Interval* value to define the spacing in Z units between adjacent contour lines. To change the value, highlight the existing value and type a new value. Contours will automatically be created with the desired *Interval* as the spacing.

Line Properties

Set the line properties for the contour levels in the Line Properties section.

Fill Properties

The *Fill Properties* section includes options for adding a color fill to the contour map and applying the color fill from a color gradient.

Fill Contours

Select the *Fill contours* property to add a color fill to the contour map.

Colormap

Set the color gradient for the color fill by selecting a predefined gradient in the *Colormap* field or click the ... button to create or modify a one in the Color Gradient dialog.

Show Color Scale

Select the *Show color scale* property to add a color scale to the plot window. Clear the *Show color scale* property to remove the color scale.

Label Properties

The Label Properties section includes the frequency, font, format, background, and spacing properties for the contour level labels. See the *Labels* topic for more information on the frequency, font, format, and background properties. The following information is specific to contour level spacing.

Curve Tolerance

Curve tolerance specifies the maximum amount of contour curvature allowed when placing labels on contour lines. *Curve tolerance* is calculated by dividing the actual distance along the contour line by the straight-line distance between the end points of the contour label. Highly curved lines might not be labeled automatically. You can increase the curve tolerance value to allow labels on highly curved contour lines, although contour labels might be hard to read. The default *Curve tolerance* value of 1.01 should be acceptable in most cases.

Label to Label Distance

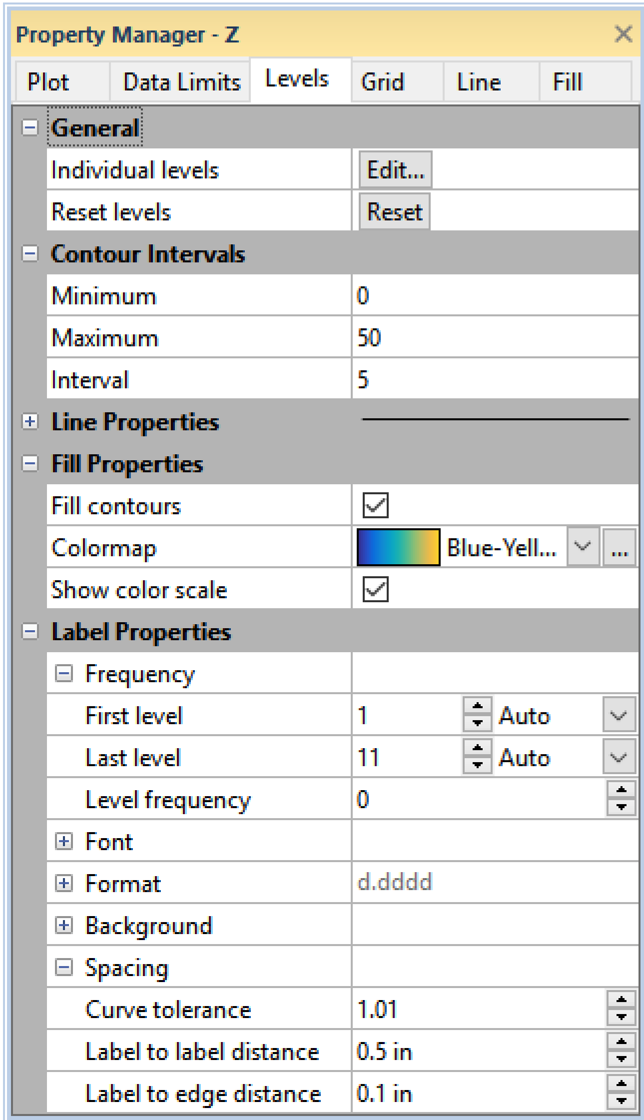
Label to label distance specifies the minimum distance (in inches or centimeters) between labels along the contour line. Grapher searches for the next suitable location for a label after moving the minimum distance specified by the *Label to label distance*. The next label is not drawn until a segment of the necessary length within the curve tolerance limits is found. As the *Label to label distance* is increased, fewer labels are drawn on the contours.

Label to Edge Distance

Label to edge distance specifies the minimum distance (in inches or centimeters) from the label to the edge of the map. This feature controls label placement so labels do not overwrite the map borders or axes.

Levels - Contour Maps

The **Levels** page in the Property Manager includes the levels properties for a contour map.



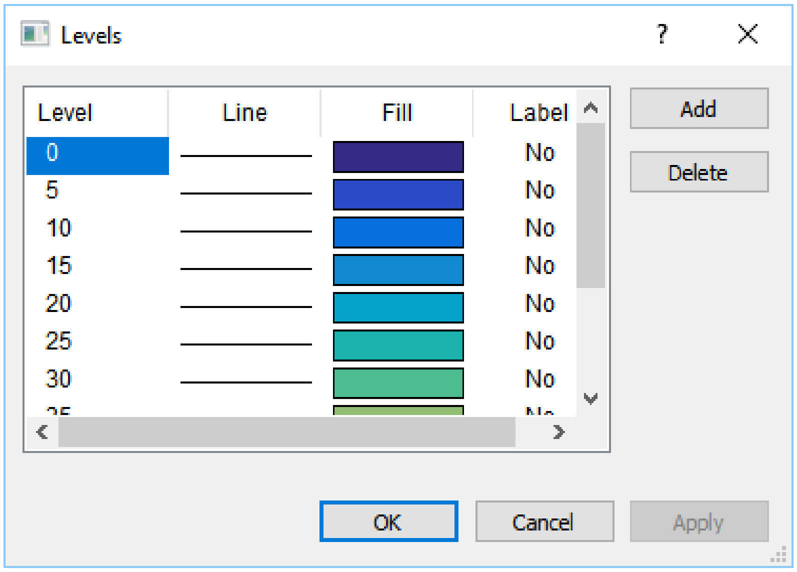
Set the contour level properties in the ***Levels*** *page.*

General

The *General* section includes properties for setting individual levels properties and returning the levels to default. Click *Edit* in the *Individual levels* field to edit individual levels in the **Levels** dialog. Click *Reset* in the *Reset levels* field to return the levels to their default properties.

Levels Dialog

The **Levels** dialog controls the display of individual contours, contour lines, and color fills on the contour map. The contour level list shows the contour levels to be displayed on the map.



*Use the **Levels** dialog to control the display of contour levels, line, and fill properties.*

Double-click any of the elements in the list to set parameters for a specific contour level.

- Double-click an individual level value to open the Set Level dialog.
- Double-click an individual line sample or fill color box to open the line and fill properties in the **Line/Fill Properties** dialog.
- Double-click and individual level label setting to toggle the label display on (*Yes*) or off (*No*).

Add

Click the *Add* button to open the **Set Level** dialog. You can define a new level and the level is added to the **Levels** dialog in the appropriate position.

Delete

Click the *Delete* buttons to delete the currently selected contour level.

Contour Intervals

The Contour Intervals section includes properties for quickly setting the contour level range and interval.

Minimum and Maximum

Enter values for the *Minimum* and *Maximum* contours in the *Contour Intervals* section. To change the value, highlight the existing value and type a new value.

Interval

Enter an *Interval* value to define the spacing in Z units between adjacent contour lines. To change the value, highlight the existing value and type a new value. Contours will automatically be created with the desired *Interval* as the spacing.

Line Properties

Set the line properties for the contour levels in the Line Properties section.

Fill Properties

The *Fill Properties* section includes options for adding a color fill to the contour map and applying the color fill from a color gradient.

Fill Contours

Select the *Fill contours* property to add a color fill to the contour map.

Colormap

Set the color gradient for the color fill by selecting a predefined gradient in the *Colormap* field or click the ... button to create or modify a one in the Color Gradient dialog.

Show Color Scale

Select the *Show color scale* property to add a color scale to the plot window. Clear the *Show color scale* property to remove the color scale.

Label Properties

The Label Properties section includes the frequency, font, format, background, and spacing properties for the contour level labels. See the *Labels* topic for more information on the frequency, font, format, and background properties. The following information is specific to contour level spacing.

Curve Tolerance

Curve tolerance specifies the maximum amount of contour curvature allowed when placing labels on contour lines. *Curve tolerance* is calculated by dividing the actual distance along the contour line by the straight-line distance between the end points of the contour label. Highly curved lines might not be labeled automatically. You can increase the curve tolerance value to allow labels on highly curved contour lines, although contour labels might be hard to read. The default *Curve tolerance* value of 1.01 should be acceptable in most cases.

Label to Label Distance

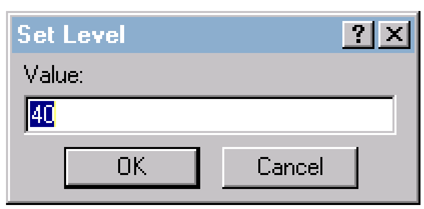
Label to label distance specifies the minimum distance (in inches or centimeters) between labels along the contour line. Grapher searches for the next suitable location for a label after moving the minimum distance specified by the *Label to label distance*. The next label is not drawn until a segment of the necessary length within the curve tolerance limits is found. As the *Label to label distance* is increased, fewer labels are drawn on the contours.

Label to Edge Distance

Label to edge distance specifies the minimum distance (in inches or centimeters) from the label to the edge of the map. This feature controls label placement so labels do not overwrite the map borders or axes.

Set Level - Contour Maps

The **Set Level** dialog is used to set an individual contour level. To open the **Set Level** dialog, double click on a level value in the Levels dialog.



Use the ***Set Level*** *dialog to specify an individual contour level.*

Value

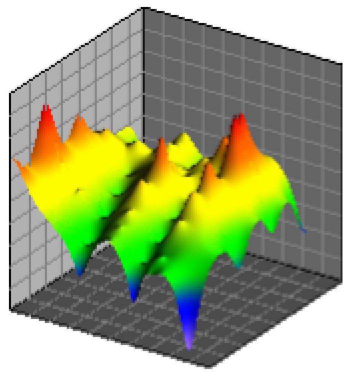
Enter a contour level in the *Value* box. The value is the actual contour line value that is to be displayed.

OK or Cancel

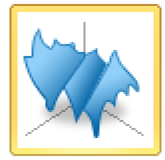
Click the *OK* button to close the dialog and save your changes. Click the *Cancel* button to close the dialog without saving your changes.

Surface Data Map

Click the **Home | New Graph | Contour Surface | Surface Data Map** command to create a surface data map.



A surface data map is created from a data file.



Click the **Surface Data Map** button to create a surface map from a data file.

Creating a New Surface Data Map

To create a surface data map:

1. Click the **Home | New Graph | Contour Surface | Surface Data Map** command.
2. Select a data file in the **Open Worksheet** dialog. You can select a new data file or you can select an open data file in the *Open worksheets* section.
3. Click the *Open* button. A surface data map is created using the default properties.

Editing Surface Data Map Properties

To change the features of the surface data map, select the surface data map and edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

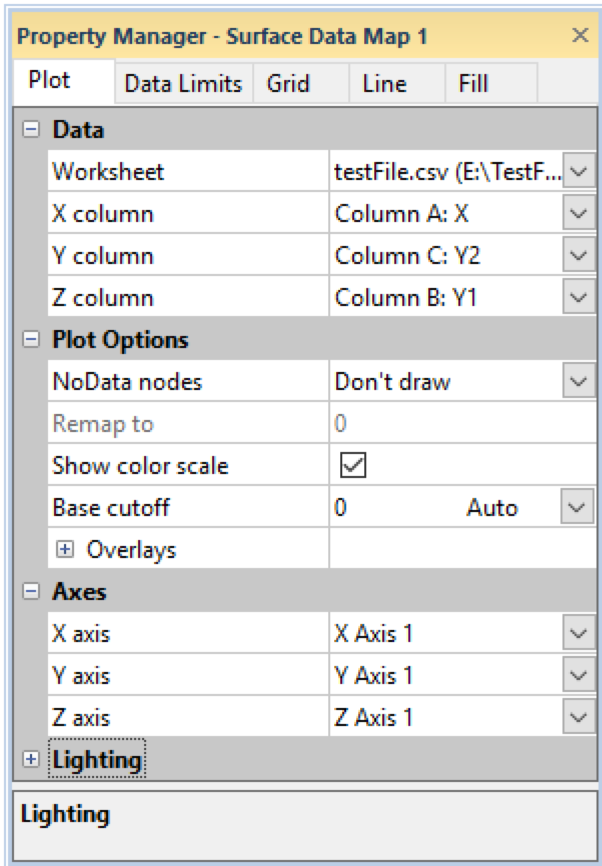
Grid

Line

Fill

Plot Page - Surface Data Maps

To view and edit surface data map plot properties, first select the map and then click the **Plot** tab in the Property Manager. You can then change the worksheet file; change axes and worksheet columns and rows; handle blanked nodes; and display or hide the color scale in the surface data map.



Set the surface map properties on the ***Plot*** *tab in the* ***Property Manager****.*

Plot Type

The *Plot type* property displays the type of plot.

Worksheet

Click the existing data file path and file name next to *Worksheet* to select a different data file for the plot. Click on a currently open worksheet or click the *Browse* option to navigate to a worksheet that is not yet open. Select a different data file in the **Open Worksheet** dialog, and click the *Open* button to change the data. The plot automatically updates.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Data Columns

Click on the column name next to the *X column*, *Y column*, and *Z column* fields to change the columns used to create the plot. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

NOTE: The worksheet columns are retained after changing the worksheet. If any of the column options are blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to column means that the column does not exist in the new worksheet.

NoData Nodes

The *NoData nodes* option sets the method used to treat nodes that have no value, i.e. the NULL value, associated with it. Set the *NoData nodes* to *Don't draw* to not draw the NoData nodes. Choose the *Remap* option to change how the NoData nodes are mapped, then enter a new value in the *Remap to* field. To change the *NoData nodes*, click on the current option and select the new option from the list.

To change the *Remap to* value, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. The *Remapto* value is in Y axis units.

Show Color Scale

Check the box next to the *Show color scale* option to show the surface data map's color scale.

Base Cutoff Value

The base extends from the bottom of the surface to the *Base cutoff* value. By default, no base is displayed. To add a base to the map, select a base fill style on the Fill page.

Control the limits of the base fill by setting *Base cutoff* value. The *Base cutoff* value is in Y axis units. If *Auto* is selected for the *Base cutoff*, a reasonable Y axis value is selected for the value. To limit the range base, you can change the *Base cutoff,* click the word *Auto*. It will change to *Custom*. You can then enter a new value into the *Base cutoff* box. To change the value, highlight the existing value and type a new value. Press ENTER on the keyboard to update the plot.

The base line and fill properties are edited on the Line and Fill pages.

Overlays

The *Overlays* section includes the properties for overlaid maps or plots.

Resample Method

When the texture map is stretched, the color in the original overlay must be resampled to a new size and position. The *Resample method* specifies how the texture map is resampled. Setting the option to *Linear* uses bilinear interpolation to combine the four surrounding pixels. Bilinear interpolation results in higher quality, but is usually slower. Setting the option to *Nearest* uses the nearest pixel in the source image. To change the *Resample method*, click on the existing method and select the desired method from the list.

Overlay Resolution

The *Overlay resolution* refers to the resolution of the texture map. High-resolution texture maps result in more detail, but lines become thinner and may eventually fade or break up. Setting the *Overlay resolution*to*Automatic*allows**Grapher**to determine the best resolution. To change the resolution, click on the existing value and select a new option from the list.

Color Modulation

Color modulation refers to the method used to combine the texture map and surface material colors. You can choose to use only the overlay colors (such as contour map colors), or you can blend the surface and overlay colors. To change the *Color modulation*, click the existing option

Overlay Visibility

If there are overlays on a surface, and the surface is made invisible through the **Object Manager**, the overlays will not be visible.

To overlay a contour map and surface map:

1. Create a contour map using the **Home | New Graph | Contour Surface | XZ Contour Data Map** or **Home | New Graph | Contour Surface | XZ Contour Grid Map** or **Home | New Graph | Contour Surface | XZ Contour Function Map** commands.
2. Add a surface map to the graph using the **Home | Add to Graph | Plot** command.
3. Select a *Surface Function Map, Surface Data Map,* or *Surface Grid Map* and click *OK*.
4. Select the axes and click *OK*.
5. Select the data file or grid file and click *Open*.
6. Click on the contour map in the **Object Manager** or plot window to select it.
7. In the **Property Manager**, click on the Plot tab. Change the *Overlay* to the surface map.
8. Click on the surface map in the **Object Manager** or plot window to select it.
9. In the **Property Manager**, click on the**Plot** tab. Set any desired overlay properties.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

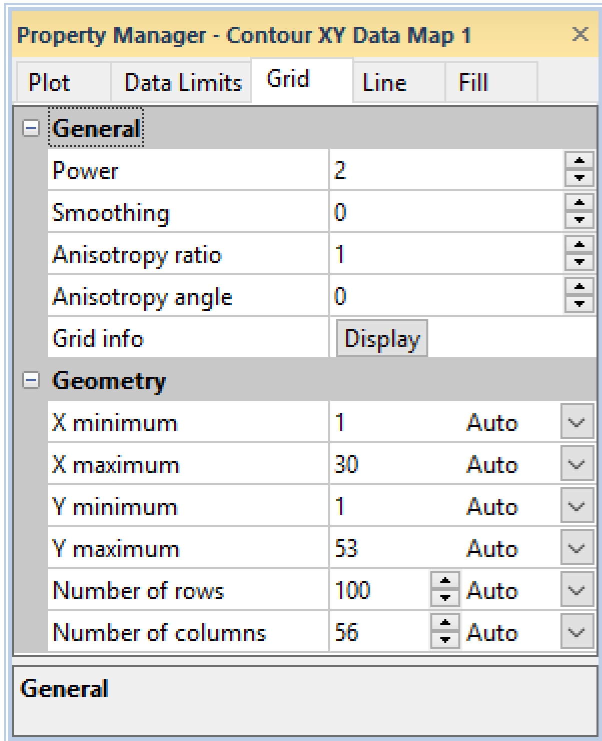
Lighting Properties

The *Lighting* section includes the lighting properties for the 3D surface.

Grid - Surface Maps

To view and edit surface data maps and surface function maps grid properties, select the map and then click the **Grid** tab in the Property

Manager. You can then set the factors used in the gridding calculation, including power, smoothing, anisotropy ratio and angle, minimum and maximum X and Y values, and number of rows and columns.



*Set the surface gridding options on the **Gridding** tab in the**Property Manager**.*

Power

The *Power* is used to change the power used by the inverse to a distance gridding calculation. This value must be between 1e-013 and 20. To change the *Power*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Smoothing

The *Smoothing* is used to change the smoothing parameter used by the inverse distance to a power gridding calculation. This value must be between 0 and 9000. When the *Smoothing* value is zero, the grid goes through every data point. The larger the smoothing factor parameter, the less overwhelming influence any particular observation has in computing a neighboring grid node. To change the *Smoothing,* highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Anisotropy Ratio

The *Anisotropy ratio* is used to control the anisotropy used by the gridding calculation. The *Anisotropy ratio* is the maximum range divided by the minimum range. An anisotropy ratio less than two is considered mild, while an anisotropy ratio greater than four is considered severe. Typically, when the anisotropy ratio is greater than three the effect is clearly visible on grid-based maps. This value must be between 1e-10 and 1e+007. To change the *Anisotropy ratio,* highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Anisotropy Angle

The *Anisotropy angle* is used to change the angle used by the gridding calculation. The *Anisotropy angle* is the preferred orientation (direction) of the major axis in degrees. Positive *Anisotropy angles* rotate counter-clockwise. This value must be between -360 and 360. To change the *Anisotropy angle,* highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Grid Info

Click the *Display* button next to the *Grid info* command to view grid information.

X Values

The *X minimum* and *X maximum* values set the extents of the gridding in the X axis direction. Leave the *Auto* box checked next to one or both to have **Grapher** automatically set the X values. To change *X minimum* or *X maximum* values, click the word *Auto* and select *Custom*. You can then enter a new value into either the *X minimum* or *X maximum* boxes. To change the value, highlight the existing number and type a new value. Press ENTER on the keyboard to update the plot. Values are in X axis units.

Click the word *Custom* and select *Auto* to go back to automatic minimum and maximum values. The word*Auto*will appear and the*X minimum* or *X maximum* will revert to the default value.

Y Values

The *Y minimum* and *Y maximum* values set the extents of the gridding in the Y axis direction. Leave the *Auto* box checked next to one or both to have **Grapher** automatically set the Y values. To change *Y minimum* or *Y maximum* values, click the word *Auto* and select *Custom*. You can then enter a new value into either the *Y minimum* or *Y maximum* boxes. To change the value, highlight the existing number and type a new value. Press ENTER on the keyboard to update the plot. Values are in Y axis units.

Click the word *Custom* and select *Auto* to go back to automatic minimum and maximum values. The word*Auto*will appear and the Y*minimum* or *Ymaximum* will revert to the default value.

Number of Rows

The *Number of rows* sets the number of grid rows to be calculated. Leave the *Auto* box checked next to the number to have **Grapher** automatically set the number of rows. The larger the *Number of rows*, the more detailed and accurate the grid will be. It will also take longer to update the graph. To change the *Number of rows*, click the word *Auto* and select *Custom*. To change the value, highlight the existing number and type a new value. Press ENTER on the keyboard to update the plot. Alternatively, click the to increase or decrease the value.

Click the word *Custom* and select *Auto* to go back to the automatic number of rows. The word *Auto* will appear and the *Number of rows* will revert to the default value.

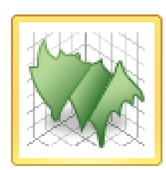
Number of Columns

The *Number of columns* sets the number of grid columns to be calculated. Leave the *Auto* box checked next to the number to have **Grapher** automatically set the number of columns. The larger the *Number of columns,* the more detailed and accurate the grid will be. It will also take longer to update the graph. To change the *Number of columns,* click the word *Auto* and select *Custom*. To change the value, highlight the existing number and type a new value. Press ENTER on the keyboard to update the plot. Alternatively, click the to increase or decrease the value.

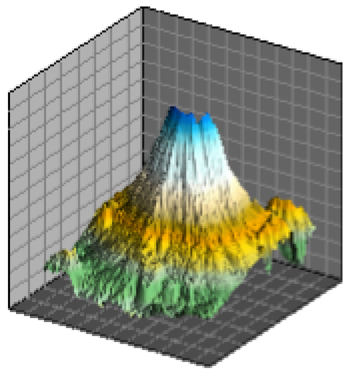
Click the word *Custom* and select *Auto* to go back to the automatic number of columns. The word *Auto* will appear and the *Number of columns* will revert to the default value.

Surface Grid Map

Click the **Home | New Graph | Contour Surface | Surface Grid Map** command to create a surface grid map. Surface grid maps are created from grid files, types of which include .GRD, .DEM, .DDF, .HDR, and .DTED. If your data is in a regular array of Z values, you may convert it to an ASCII .GRD file format.



*Click the **Surface Grid Map** command to create a surface map from a grid file.*



A surface grid map is created from a grid file.

Creating a New Surface Grid Map

To create a surface grid map:

1. Click the **Home | New Graph | Contour Surface | Surface Grid Map** command.
2. Select a grid file in the **Open Grid** dialog. You can select a new grid file or you can select an open data file in the *Open grids* section.
3. Click the *Open* button. A surface grid map is created using the default properties.

Editing Surface Grid Map Properties

To change the features of the surface grid map, select the surface grid map and edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

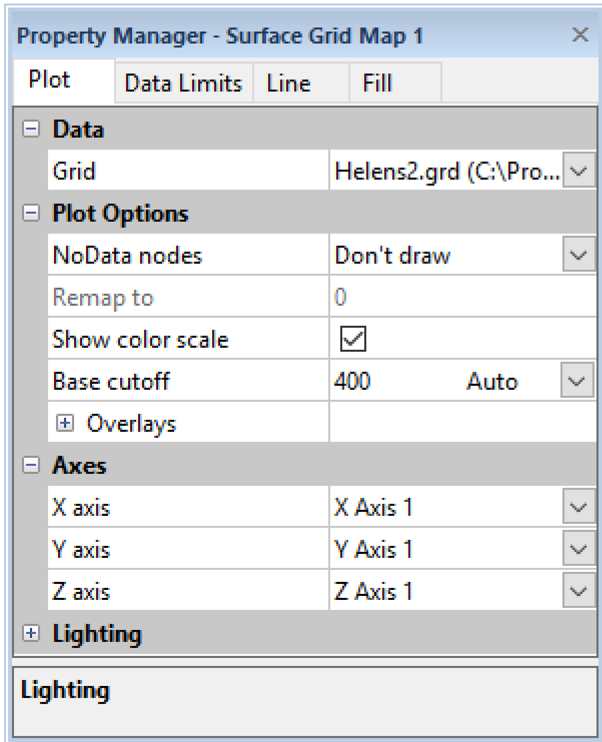
Data Limits

Line

Fill

Plot Page - Surface Grid Maps

To view and edit surface grid map plot properties, first select the map and then click the **Plot** tab in the Property Manager. You can then change the grid file; change axes; handle NoData nodes; and display or hide the color scale in the surface grid map.



*Set the surface map properties on the **Plot** tab in the **Property Manager**.*

Plot Type

The *Plot type* property displays the type of plot.

Grid

Click the current grid file path and file name next to *Grid* to select a different grid file for the plot. Click on a currently open grid or click the *Browse* option to navigate to a grid that is not yet open. Select a different data file in the**Open Worksheet**dialog, and click the *Open* button to change the grid file. The plot automatically updates.

NoData Nodes

The *NoData nodes* option sets the method used to treat nodes that have no value, i.e. the NULL value, associated with it. Set the *NoData nodes* to *Don't draw* to not draw the NoData nodes. Choose the *Remap* option to change how the NoData nodes are mapped, then enter a new value in the

Remap to field. To change the *NoData nodes*, click on the current option and select the new option from the list.

To change the *Remap to* value, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. The *Remapto* value is in Y axis units.

Show Color Scale

Check the box next to the *Show color scale* option to show the surface data map's color scale.

Base Cutoff Value

The base extends from the bottom of the surface to the *Base cutoff* value. By default, no base is displayed. To add a base to the map, select a base fill style on the Fill page.

Control the limits of the base fill by setting *Base cutoff* value. The *Base cutoff* value is in Y axis units. If *Auto* is selected for the *Base cutoff*, a reasonable Y axis value is selected for the value. To limit the range base, you can change the *Base cutoff,* click the word *Auto*. It will change to *Custom*. You can then enter a new value into the *Base cutoff* box. To change the value, highlight the existing value and type a new value. Press ENTER on the keyboard to update the plot.

The base line and fill properties are edited on the Line and Fill pages.

Overlays

The *Overlays* section includes the properties for overlaid maps or plots.

Resample Method

When the texture map is stretched, the color in the original overlay must be resampled to a new size and position. The *Resample method* specifies how the texture map is resampled. Setting the option to *Linear* uses bilinear interpolation to combine the four surrounding pixels. Bilinear interpolation results in higher quality, but is usually slower. Setting the option to *Nearest* uses the nearest pixel in the source image. To change the *Resample method*, click on the existing method and select the desired method from the list.

Overlay Resolution

The *Overlay resolution* refers to the resolution of the texture map. High-resolution texture maps result in more detail, but lines become thinner and may eventually fade or break up. Setting the *Overlay resolution* to *Automatic* allows **Grapher** to determine the best resolution. To change the resolution, click on the existing value and select a new option from the list.

Color Modulation

Color modulation refers to the method used to combine the texture map and surface material colors. You can choose to use only the overlay colors (such as contour map colors), or you can blend the surface and overlay colors. To change the *Color modulation* , click the existing option

Overlay Visibility

If there are overlays on a surface, and the surface is made invisible through the **Object Manager**, the overlays will not be visible.

To overlay a contour map and surface map:

1. Create a contour map using the **Home | New Graph | Contour Surface | XZ Contour Data Map** or **Home | New Graph | Contour Surface | XZ Contour Grid Map** or **Home | New Graph | Contour Surface | XZ Contour Function Map** commands.
2. Add a surface map to the graph using the **Home | Add to Graph | Plot** command.
3. Select a *Surface Function Map, Surface Data Map,* or *Surface Grid Map* and click *OK*.
4. Select the axes and click *OK*.
5. Select the data file or grid file and click *Open*.
6. Click on the contour map in the **Object Manager** or plot window to select it.
7. In the **Property Manager**, click on the Plot tab. Change the *Overlay* to the surface map.
8. Click on the surface map in the **Object Manager** or plot window to select it.
9. In the **Property Manager**, click on the**Plot** tab. Set any desired overlay properties.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

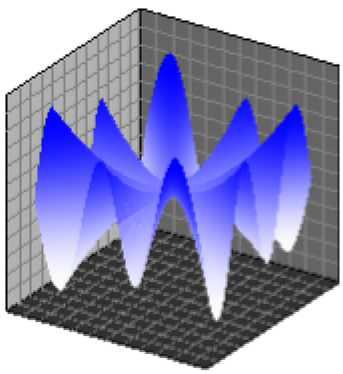
See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

Lighting Properties

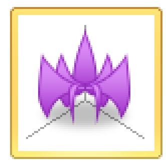
The *Lighting* section includes the lighting properties for the 3D surface.

Surface Function Map

Click the **Home | New Graph | Contour Surface | Surface Function Map** command to create a surface function map.



A surface function map is created from a function in the form of Y=F(X, Z).



*Click the **Surface Fumction Map** command to create a surface map.*

Creating a New Surface Function Map

To create a surface function map:

1. Click the **Home | New Graph | Contour Surface | Surface Function Map** command.
2. A surface function map is created using the default properties.
3. Use thePlottab in the Property Manager to assign a function to the graph.

Editing Surface Function Map Properties

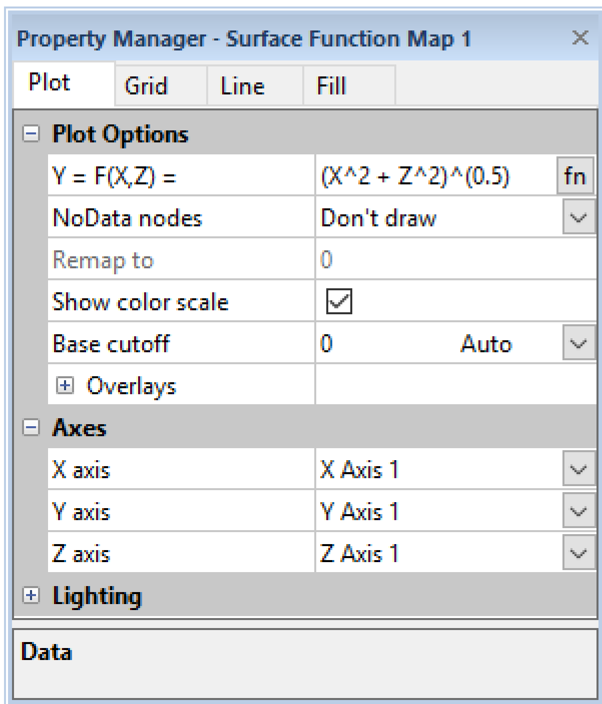
To change the features of the surface function map, select the surface function map and edit its properties in the Property Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot
Grid
Line
Fill

Plot - Surface Function Maps

To view and edit surface function map plot properties, first select the map and then click the **Plot** tab in the Property Manager. You can then change axes; set the Y equation; set X values and Z values; and display or hide the color scale in a surface function map.



*Set the surface map properties on the **Plot** tab in the **Property Manager**.*

Plot Type

The *Plot type* property displays the type of plot.

Set Equation for Y

Select the text next to *Y = F(X,Z)* = to change the function being plotted for Y. Click the fn button to open the Functions dialog and add predefined mathematical equations to the function, or type functions into the field manually. Press ENTER on the keyboard to make the change.

NoData Nodes

The *NoData nodes* option sets the method used to treat nodes that have no value, i.e. the NULL value, associated with it. Set the *NoData nodes* to *Don't draw* to not draw the NoData nodes. Choose the *Remap* option to change how the NoData nodes are mapped, then enter a new value in the *Remap to* field. To change the *NoData nodes*, click on the current option and select the new option from the list.

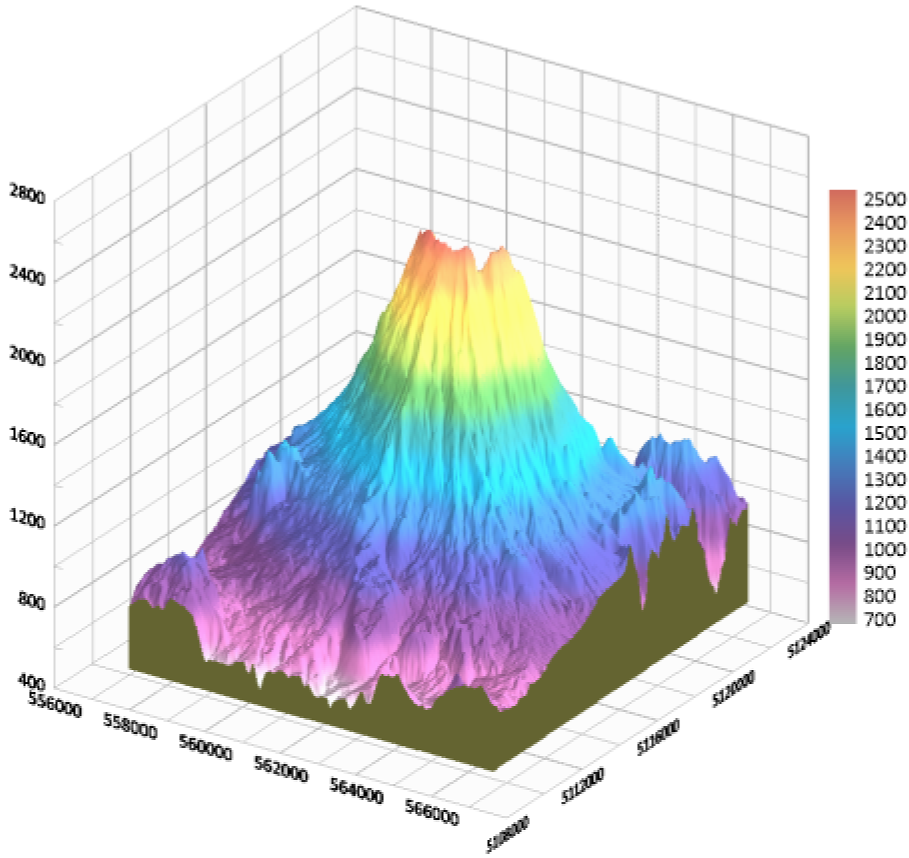
To change the *Remap to* value, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. The *Remapto* value is in Y axis units.

Show Color Scale

Check the box next to the *Show color scale* option to show the surface data map's color scale.

Base Cutoff Value

The base is a fill that extends from the bottom of the surface to the *Base cutoff* value. The base gives the surface a volumetric appearance by adding sides and a bottom to the map. By default, no base is displayed. To add a base to the surface map, select a base fill style on the Fill page. The base can include an outline. Add the base line by selecting a line style on the Line page.



The base adds a fill below the surface from the surface to the Base cutoff *value.*

Control the limits of the base fill by setting *Base cutoff* value. The *Base cutoff* value is in Y axis units. If *Auto* is selected for the *Base cutoff*, a reasonable Y axis value is selected for the value. To limit the range base, you can change the *Base cutoff,* click the word *Auto*. It will change to *Custom*. You can then enter a new value into the *Base cutoff* box. To change the value, highlight the existing value and type a new value. Press ENTER on the keyboard to update the plot.

The base line and fill properties are edited on the Line and Fill pages.

Overlays

The *Overlays* section includes the properties for overlaid maps or plots.

Resample Method

When the texture map is stretched, the color in the original overlay must be resampled to a new size and position. The *Resample method* specifies how the texture map is resampled. Setting the option to *Linear* uses bilinear interpolation to combine the four surrounding pixels. Bilinear interpolation results in higher quality, but is usually slower. Setting the option to *Nearest* uses the nearest pixel in the source image. To change the *Resample method*, click on the existing method and select the desired method from the list.

Overlay Resolution

The *Overlay resolution* refers to the resolution of the texture map. High-resolution texture maps result in more detail, but lines become thinner and may eventually fade or break up. Setting the *Overlay resolution*to*Automatic*allows**Grapher**to determine the best resolution. To change the resolution, click on the existing value and select a new option from the list.

Color Modulation

Color modulation refers to the method used to combine the texture map and surface material colors. You can choose to use only the overlay colors (such as contour map colors), or you can blend the surface and overlay colors. To change the *Color modulation*, click the existing option

Overlay Visibility

If there are overlays on a surface, and the surface is made invisible through the **Object Manager**, the overlays will not be visible.

To overlay a contour map and surface map:

1. Create a contour map using the **Home | New Graph | Contour Surface | XZ Contour Data Map** or **Home | New Graph | Contour Surface | XZ Contour Grid Map** or **Home | New Graph | Contour Surface | XZ Contour Function Map** commands.
2. Add a surface map to the graph using the **Home | Add to Graph | Plot** command.
3. Select a *Surface Function Map, Surface Data Map,* or *Surface Grid Map* and click *OK*.
4. Select the axes and click *OK*.
5. Select the data file or grid file and click *Open*.
6. Click on the contour map in the **Object Manager** or plot window to select it.
7. In the **Property Manager**, click on the Plot tab. Change the *Overlay* to the surface map.
8. Click on the surface map in the **Object Manager** or plot window to select it.

9. In the **Property Manager**, click on the **Overlays** tab. Set any desired overlay properties.

Change Axes

Click on the axis name next to the *X axis*, *Y axis*, or *Z axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

Lighting Properties

The *Lighting* section includes the lighting properties for the 3D surface.

Lighting Properties

To view and edit lighting properties for the surface data map, surface grid map, surface function map, 3D bubble plots, 3D pie charts, and 3D doughnut plots, first select the plot or map. Then click the **Plot** tab in the Property Manager. You can then set the lighting type; horizontal and vertical angles; ambient, diffuse, and specular colors; and surface shininess.

Lighting

Click the text next to *Lighting* to modify the lighting properties. There are three lighting options: *None*, *Smooth*, and *Flat*. *None* disables all lighting effects. The color shown is from the surface material color only. Each grid cell is divided into two triangular polygons. With *Smooth* lighting, Gouraud shading is used to interpolate colors within the triangles from the three vertices of each triangle. This results in smooth transitions across the triangles and the entire grid, but it is slightly slower than flat shading. With *Flat* lighting, only one vertex (grid node) is used to define the shaded color for the entire polygon. Note that each grid cell is divided into two triangular polygons. This results in a faceted look since each triangle is only filled with a single color.

To change the *Lighting*, click on the existing option and select a new value from the list.

Angles

The *Horizontal* and *Vertical* define the angle from which the light is shined onto the surface. These values must be between -360 and 360 degrees. To change the *Horizontal* or *Vertical* value, highlight the existing value and type a new number. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the value.

Colors

There are three different types of light color, *Ambient*, *Diffuse,* and *Specular.* Note that these colors are used to represent reflectivity. White is 100% reflective and reflects the material color unaltered to the viewer. Black is 0% reflective, and causes all material color to be absorbed. Our perception of color is based on reflected and absorbed light. For example, a leaf appears green because it absorbs all colors in the light spectrum EXCEPT green. Since only green is reflected to your eye, the leaf appears green.

Grapher uses a pure white light source. The light "strikes" the surface and some of the light is absorbed based on the color of the surface material at the point the light ray struck it. Some light is reflected to the viewer according to the type of light (*Ambient, Diffuse*, and *Specular*), and the reflectivity color associated with each type of light.

Ambient refers to light that has been scattered so evenly by the environment that its direction is impossible to determine. Increasing the ambient light component brightens the scene without casting shadows. The default *Ambient* color is 90% black which means that the ambient light contribution is fairly small.

Diffuse refers to light coming from a particular direction and is brighter if aimed directly down on a surface than barely glancing off the surface. When diffuse light hits the surface, it is scattered uniformly in all directions so that it appears equally bright no matter where the eye is located. Increasing diffuse light intensifies shadow effects. The default *Diffuse* color is white, which is the maximum amount of reflectivity.

Specular refers to light coming from a particular direction, and tends to bounce off the surface in a preferred direction. A shiny surface such as metal has a high specular component, while a surface like carpet has almost no specular component. Increasing the percentage of specular light results in strong shadow effects and more pronounced "shiny" or glare spots. The default *Specular* color is 90% black.

In general, these reflectivity colors should be specified as shades of gray in order to evenly reflect the surface material color components. However, special effects are possible by specifying non-gray colors for the reflectivity. For example, assume the *Ambient* reflectivity is set to pure red, and the *Diffuse* and *Specular* components are set to pure black. The *Diffuse* and *Specular* components are essentially disabled by setting their reflectivity color to black. The only light that is reflected to the viewer is red ambient light. Portions of the surface that lack a red component in the material color will appear black, since only red light is reflected to the viewer.

To change the *Ambient, Diffuse,* or *Specular* color, click the existing color sample to open the color palette. Click on a color in the palette to use it for the selected color. Click the ... button to the right of the color sample to open the **Colors** dialog, setting a custom color.

Shininess

Shininess controls the size of the specular reflections. As the shininess increases, the reflections become more focused. Select a value between 1 and 128. To change the value, highlight the existing *Shininess* value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Color Scale - Surface Maps, Vector Plots, Color Mapped Symbols

A color scale is a legend that shows the colors used in a surface map, vector plot, or color mapped symbols in a scatter plot.

Adding a Color Scale

To add a color scale to a surface map, check the box next to the *Show color scale* option on the Plot page to activate the color scale. To add a color scale to a vector plot, check the box next to *Show color scale* on the Line page to activate the color scale. To add a color scale to a scatter plot, check the box next to Show color scale on the Symbol page. The color scale appears next to the surface map or vector plot in the plot window.

Removing a Color Scale

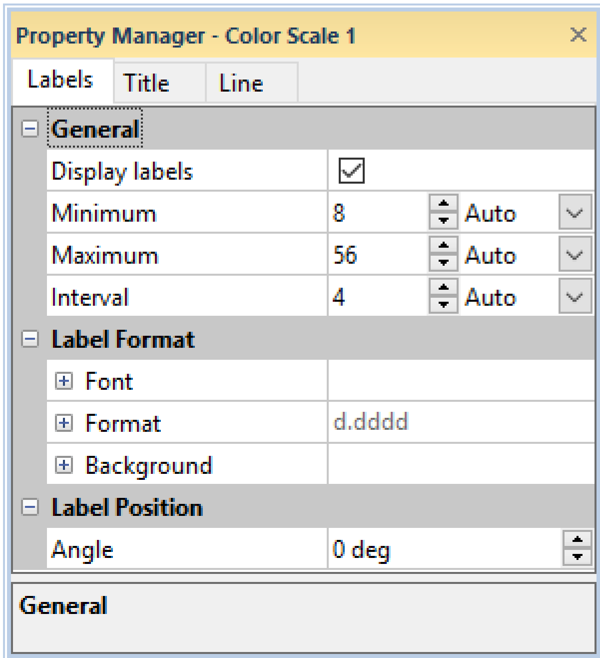
To remove a color scale, clear the *Show color scale* box in the **Property Manager** or clear the *Color Scale* visibility check box in the **Object Manager**.

Adding and Editing a Title

Click the **Title** tab to add a title and edit the title properties.

Editing a Color Scale

To modify the color scale, click the color scale name in the **Object Manager** to display its properties in the **Property Manager**. Click the **Labels** tab to access the color scale's label properties. There are three tabs: **Labels**, Title, and Line. The **Labels** tab options are described below.



*The **Labels** tab controls the display options of the color scale bar for a surface map or vector plot.*

Display Labels

Check the box next to to *Display labels* to turn the scale labels on or off.

Label Range

Set the first label value in the *Minimum* box. Set the last label value in the *Maximum* box. To change the values, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. To return to the default *Minimum* or *Maximum* values, click the *Custom* option and select *Auto*. Alternatively, press the  to increase or decrease the step value.

Label Interval

Define the spacing between labels in the *Interval* box. One draws every label, two draws every other label, etc. Choose the angle at which the labels are drawn in the *Angle* box. Positive values rotate the labels counterclockwise. To change the value, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. To return to the default *Interval* value, click the *Custom* option option and select *Auto*.

Label Font

Click the ⊞ next to *Font* to set the label font properties. The font *Face, Size (points), Color, Opacity, Bold, Italic, Underline,*and*Strikethrough*properties can be set for most labels.

Label Format

Click the ⊞ next to *Format* to set the label format properties. The label *Type,* display of numbers, *Prefix,* and *Suffix* can be set for labels.

Label Background

Click the ⊞ next to *Background* to set the label background properties. The *Background* is the area behind the label. Click the ⊞ next to *Line* to set the line properties for the line that goes around the text. Click the ⊞ next to *Fill* to set the fill properties for the area around the text.

Label Angle

You can enter a number into the *Angle* box to rotate the labels. Positive values rotate the label in a counter-clockwise direction. The *Angle* is specified in degrees. To enter an angle, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the ⬍ to increase or decrease the value.

Fit Curves

Fit curves are a collection of predefined mathematical functions that you can add to your graph to compare the behavior of your plot with known functions. In addition to the predefined fit curves, you can also create your own custom fit curves. Fit curves can be added to line/scatter plots, step plots, polar plots, and histograms; to 3D ribbon/wall, step plots, and histograms; and to 3D XYZ line/scatter plots and XYZ bar charts.

Adding a Fit to a Plot

To add a fit to a plot:

1. Select a plot in the Object Manager or plot window.
2. Click the **Home | Add to Graph | Fit Curve** command. A linear fit is added by default. The fit type can be changed in the **Property Manager**Plot page.

Editing Fit Plot Properties

To change the features of a fit plot, including the number of points on the fit curve, open the fit plot properties by selecting the fit plot and editing the properties in the **Property Manager**. You may also add confidence intervals to a selected fit.

You can change the following fit plot properties:

Plot

Data Limits

Symbol (2D plots only)

Line

Fill

Available Fits

The following predefined fits are available in the *Available Fits* drop-down list.

Linear

The *Linear* fit displays a straight-line fit through the data.

$$Y = bX + a$$

Log

The *Log* fit displays a natural logarithmic fit through the data.

$$Y = b(\ln X) + a$$

Exponential

The *Exponential* fit displays an exponential fit through the data.

$$\ln Y = bX + a$$

or

$$Y = ae^{bX}$$

Power

The *Power* fit displays a power fit through the data.

$$\ln Y = b(\ln X) + a$$

or

$$Y = aX^{b}$$

Spline Smoothing

Spline smoothing produces a uniform curve that passes through all of the data points, regardless of the spacing of the data points or the tension factor applied to the spline fit. Tension factors range from one to 50. Higher tension factors result in straighter lines between the data points and lower tension factors result in more curvature to the fit line. Spline fits do not extrapolate beyond the maximum or minimum data values displayed for the curve. There is not an equation for the *Spline smoothing* fit.

Polynomial

The *Polynomial* regression fit displays a curve based on the equation below. The polynomial degree can be set from zero to 10. A polynomial degree of zero is the average Y value, degree one is a linear fit, degree two is a quadratic fit, degree three is a cubic fit, and degree four is a quadric fit.

$$Y = a_0 + a_1X^1 + a_2X^2 + \cdots + a_nX^n$$

Orthogonal Polynomial

The *Orthogonal polynomial* regression fit is an alternate method for calculating polynomial regressions. The *Orthogonal polynomial* equation has been converted to "normal" polynomial form, so Y can be calculated from a given X with the equation. Alternatively, Y can be calculated from a given X using the orthogonal factors.

Through Origin

The linear fit through the origin forces the linear fit line through the origin (0,0).

$$Y = bX$$

Running Average

Running average fits are generated by taking the average of the data within a specified range on either side of a given point. The window width controls the range of data used in the calculation, and this number must be an odd number between 3 and 1001. For example, the default *Window width* of 5 averages the data point, the two values above the data point, and the two values below the point. The average of all five values is plotted as part of the fit line. The fit line connects all the average points. The *Running average* is truncated short of the data limits by a factor of (Window Width - 1)/2 so the fit does not extend to the limits of the plotted data curve.

Weighted Average

The *Weighted average* fit is similar to the *Running average* fit. Instead of averaging the points in the *Window width* equally, a weight is provided for each of the data points (*Order*) within the window. In a running average fit, all of the weights are equal to one. Therefore, the weighted average fit should provide the same fit as the running average fit if all of the weights are set to one.

LOESS (LOWESS)

The *LOESS (LOWESS)* fit method fits simple polynomial models to localized subsets of the data. The LOESS (LOWESS) fit is defined by the *Span*, *Family*, and *Degree*. The *Span* is the proportion of the data used to fit the local polynomial at each point. The *Span* can vary between 0.1 (10%) and 1.0 (100%) of the data. Typically values between 0.25 and 0.5 are appropriate for the *Span* parameter. The *Span* is sometimes referred to as the smoothing parameter. The *Family* option determines the fit algorithm. When *Family* is set to *Gaussian*, a least squares fit is used. A redescending M estimator with Tukey's biweight or bisquare function is used to fit the data when *Family* is set to *Symmetric*. The *Degree* specifies the order of the local polynomials fit to each subset of the data. A *Degree* of *1 (Linear)* fits a linear function to each data subset. A *Degree* of *2 (Quadratic)* fits a quadratic function to each data subset.

See Cleveland, W.S. (1979) "Robust Locally Weighted Regression and Smoothing Scatterplots," *Journal of the American Statistical Association*, Vol. 74, pp. 829-836. for more information about the LOESS fit.

RMA (Reduced Major Axis)

The *RMA* fit method fits a linear regression model to the data by minimizing the sum of squares of the perpendicular distance between each data point and the regression line. The *RMA* method is different from the *Linear* fit, as the *Linear* fit uses the ordinary least squares method to minimize the sum of squares of the residuals, i.e. the vertical distance between the data points and the regression line. The *RMA* fit method is a common method for handling variability in both x and y.

Normal Distribution (Gaussian)

The *Normal distribution* fit is used with Histogramsand3D Histograms.

$$f(y) = \frac{e^{\wedge}\left(-(y-\mu)^2/2\sigma^2\right)}{\sigma\sqrt{2\Pi}} \cdots \sigma > 0, -\infty < \mu < \infty, -\infty < y < \infty$$

Lognormal Distribution

The *Lognormal distribution* fit is used with Histogramsand3D Histograms.

$$F(x;\mu,\sigma) = \frac{1}{2}(1 - \mathrm{erf}(-\frac{\log(x)-\mu}{\sqrt{2}\sigma}))$$

μ = scale parameter, σ = shape parameter

μ, σ > 0

erf = standard error function

Exponential Distribution

The *Exponential distribution* fit is used with Histogramsand3D Histograms.

$$F(x;\sigma,\theta) = 1 - e^{-(x-\theta)/\sigma}$$

θ = location parameter, σ = scale parameter

x≥θ, and σ > 0

Power Distribution

The *Power distribution* fit is used with Histogramsand3D Histograms.

$$F(x;a,\theta) = 1 - \left(\frac{a}{x}\right)^{\theta}$$

q = shape parameter, α = location parameter

q > 0, and α > 0

Inverse Gaussian Distribution

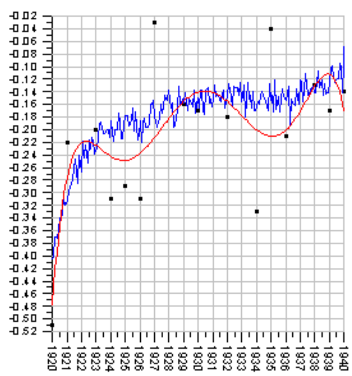
The *Inverse Gaussian distribution* fit is used with Histogramsand3D Histograms.

$$F(x;\alpha,\beta,\gamma) = \frac{\Gamma_{x-\gamma}(\alpha,\beta/(x-\gamma)}{\Gamma(\alpha)}$$

α= shape parameter, β= scale parameter

Orthogonal Polynomial Regression

Orthogonal polynomial regression is appropriate and sometimes necessary for higher order polynomial fits, i.e., five degrees and higher. Orthogonal polynomial regression can be used in place of polynomial regression at any time. In the graphic below, the blue curve is a sixth degree polynomial regression and the red curve is a sixth degree orthogonal polynomial regression. Unstable polynomial regressions of this sort can result from round off and truncation errors in the computer arithmetic. The result is a "squiggly" fit line. If the resulting polynomial coefficients are extremely large, relatively small Y values cannot be accurately calculated. Use orthogonal polynomial regression if the polynomial regression oscillates excessively, such as the blue line in the graphic below, or when Y values calculated from the polynomial equation are not approximating the fit curve closely enough.



Statistics

The orthogonal polynomial regression statistics contain some standard statistics such as a fit equation, polynomial degrees (changed with fit plot properties), and the number of data points used as well as some statistics specific to the orthogonal polynomial such as B[n], Alpha[n], and Beta[n].

Polynomial Factors

Since this is an orthogonal method of calculating the polynomial regression, each degree’s orthogonal polynomial factors are independent of each other. The degree zero results are the optimal zero order fit, the degree one results are the optimal first order fit, and so on. Adding more degrees to the fit does not change the previous degrees' orthogonal polynomial factors. For example, if a fourth degree orthogonal polynomial regression is calculated from a data set and a separate eighth degree orthogonal polynomial regression is calculated from the same data set, the orthogonal polynomial factors will be the same for degrees zero through four in both statistics results.

Coefficient of Determination

The residual sum of squares and the coefficient of determination (R^2) are given for each polynomial degree. The R^2 values may be used to indicate when adding degrees do not significantly improve the fit. An R^2 value of zero means that no data variation is explained by the orthogonal polynomial degree and an R^2 value of one means that all of the data variation is explained by an orthogonal polynomial degree.

Orthogonal Factors

There are two options for calculating Y from a given X with the orthogonal polynomial regression statistics. The simplest method is to use the equation provided in the fit statistics. The orthogonal polynomial factors have been converted to polynomial regression equation coefficients, so that Y can be calculated from X. Alternatively, Y can be calculated from X by using the orthogonal factors: X shift, X scale, B[k], α[k], and β[k].

$$Y_{[k]} = B_{[k]} + XY_{[k+1]} - \alpha_{[k+1]}Y_{[k+1]} - \beta_{[k+1]}Y_{[k+2]}$$

where:

X = XScale*(X-XShift)

k = n, n-1,...,0 where: n is the polynomial degree

$Y_{[n+1]}$ and $Y_{[n+2]}$ = 0 where: n is the polynomial degree

The original X value is scaled before using it in the equation. The highest order equation is calculated first, then the results from that equation are used in the next lower order equation, and so on, until the zero degree equation is solved.

Example

The orthogonal polynomial regression was used as a fit on a data set. X shift, X scale, B[k], α[k], and β[k] are reported in the fit statistics. In this example, Y is calculated for X = 1940. The following table shows the resulting orthogonal factors for a fourth degree orthogonal polynomial regression:

$X_{original}$=	1940				
X Shift =	1802.5				
X Scale =	0.011080332				
X =	1.523545706				
k	$B_{[k]}$	$Alpha_{[k]}$	$Beta_{[k]}$		
0	0.000618785	0	0	E	$Y_{[0]}$
1	0.061294279	-1.03048324937583E-16	1.34072022160664	D	$Y_{[1]}$
2	0.022631233	1.09800605969503E-16	1.07255162253205	C	$Y_{[2]}$
3	0.063419368	1.05785701857996E-16	1.03420674444531	B	$Y_{[3]}$
4	-0.018901462	-1.31982972021691E-17	1.02138419382762	A	$Y_{[4]}$
k+1		0	0	0	$Y_{[k+1]}$
k+2				0	$Y_{[k+2]}$

To begin calculating Y, first adjust the X value with the X shift and X scale values:

$$X = XScale \times \left(X_{orginal} - XShift\right)$$

$$X = 0.011080332 \times (1940 - 1802.5)$$

$$X = 1.523545706$$

The solution for Y is found by solving the equation below recursively, starting from the highest order (A) and working toward the lowest order (E).

$$Y_{[k]} = B_{[k]} + XY_{[k+1]} - \alpha_{[k+1]} Y_{[k+1]} - \beta_{[k+1]} Y_{[k+2]}$$

where:

X = XScale*(X-XShift)

k = n, n-1,...,0 where: n is the polynomial degree

$Y_{[n+1]}$ and $Y_{[n+2]}$ = 0 where: n is the polynomial degree

The following are the equations for solving for Y given 1940 as X (remember that the adjusted X is used in the equation):

$$Y_{[4]} = B_{[4]} + (X)(Y_{[k+1]}) - (\alpha_{[k+1]})(Y_{[k+1]}) - (\beta_{[k+1]})(Y_{[k+2]})$$

$$Y_{[3]} = B_{[3]} + (X)(Y_{[4]}) - (\alpha_{[4]})(Y_{[4]}) - (\beta_{[4]})(Y_{[k+1]})$$

$$Y_{[2]} = B_{[2]} + (X)(Y_{[3]}) - (\alpha_{[3]})(Y_{[3]}) - (\beta_{[3]})(Y_{[4]})$$

$$Y_{[1]} = B_{[1]} + (X)(Y_{[2]}) - (\alpha_{[2]})(Y_{[2]}) - (\beta_{[2]})(Y_{[3]})$$

$$Y_{[0]} = B_{[0]} + (X)(Y_{[1]}) - (\alpha_{[1]})(Y_{[1]}) - (\beta_{[1]})(Y_{[2]})$$

The results for $Y_{[n]}$ are shown in blue and red in the following table. Given X=1940, Y=0.13 ($Y_{[0]}$).

$X_{original}$=	1940				
X Shift =	1802.5				
X Scale =	0.011080332				
X =	1.523545706				
k	$B_{[k]}$	$Alpha_{[k]}$	$Beta_{[k]}$		
0	0.000618785	0	0	0.130501877	$Y_{[0]}$
1	0.061294279	-1.03048324937583E-16	1.34072022160664	0.168786866	$Y_{[1]}$
2	0.022631233	1.09800605969503E-16	1.07255162253205	0.094927645	$Y_{[2]}$
3	0.063419368	1.05785701857996E-16	1.03420674444531	0.034622127	$Y_{[3]}$
4	-0.018901462	-1.31982972021691E-17	1.02138419382762	-0.018901462	$Y_{[4]}$
k+1		0	0	0	$Y_{[k+1]}$
k+2				0	$Y_{[k+2]}$

Orthogonal Polynomial Regression References

Clenshaw, C.W. 1962. *Mathematical Tables*, Volume 5, Chebyshev Series for Mathematical Functions, National Physical Laboratory. London: Her Majesty's Stationary Office.

Dahlquist, G., and A. Bjorck. 1974. *Numerical Methods*. Englewood Cliffs, New Jersey: Prentice Hall.

Hildebrand, F.B. 1974. *Introduction to Numerical Analysis*. New York: Dover Publications, Inc. (see Least-Squares Polynomial Approximation particularly Clenshaw's method)

Hostetter, Gene H. et al. 1991. *Analytical, Numerical, and Computational Methods for Science and Engineering*. Englewood Cliffs, New Jersey: Prentice Hall.

Kronsjo, Lydia. 1987. *Algorithms: Their Complexity and Efficiency*. New York: John Wiley and Sons Ltd.

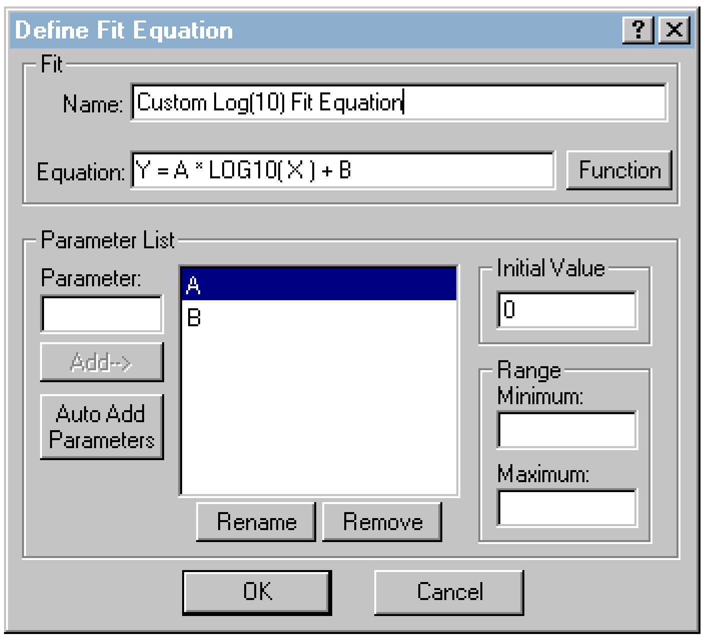
Lakshmikantham, V., and D. Trigiante. 1988. *Theory of Difference Equations: Numerical Methods and Applications*. San Diego: Academic Press, Inc.

Press, William H. et al. 1992. *Numerical Recipes in C: The Art of Scientific Computing*. New York: Cambridge University Press.

Winograd, S. 1970. *On the Number of Multiplications Necessary to Compute Certain Functions*. Communications on Pure and Applied Mathematics. 23:165-179.

Define Fit Equation

The **Define Fit Equation** dialog is used to define custom fits. Custom fit types are added to the list in the fit curve Plot page. Click the **Home | Add to Graph | Fit Curve | Define Custom Fit** command to open the **Define Fit Equation** dialog.



Use the ***Define Fit Equation*** *dialog to define custom fits.*

Defining Custom Fits

To define a custom fit:

1. Type the name of the custom fit into the *Name* field.
2. Type the fit equation, using mathematical functions, into the *Equation* field. For example, a fourth degree polynomial fit would be written as:

$$Y = a_0 + a_1 X^1 + a_2 X^2 + a_3 X^3$$

This equation is entered into the *Equation* field as:

Y=a+b*X+c*X^2+d*X^3

You can click the *Function* button to open the Functions dialog and add one of the predefined mathematical functions.

3. Type the equation parameters (variables) into the *Parameter* box, and then click the *Add* button to add the parameter to the parameter list. Alternatively, click the *Auto Add Parameters* button to let **Grapher** add the parameters automatically. To rename a parameter after it has been entered, type a new parameter name in the *Parameter* box, select the parameter from the list to rename, click the *Rename* button. To remove a parameter after it has been entered, select the parameter from the list then click the *Remove* button.
4. If you have an initial guess and/or specific ranges for the parameters, set the parameter *Initial Value*, *Minimum* range, and *Maximum* range by clicking on the parameter in the list box and entering the desired values.
5. Click the *OK* button to add the custom fit to the graph. The new custom fit will be available in the *Fit type* list for all fit curves.

Editing a Custom Fit Used in a Plot

To edit a fit that is in use by a plot, select the fit and edit the fit properties in the Property Manager on the Plot tab.

Deleting Custom Fits

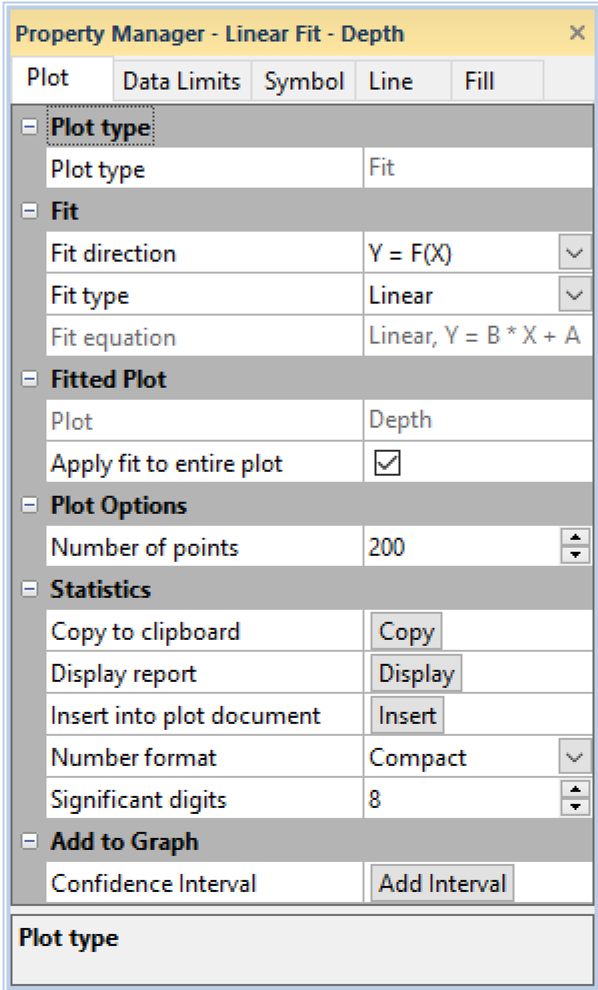
To remove a fit from the *Fit type* list, select the custom fit type and click *Remove* next to *Remove fit from types* property.

Fits and Polar Type Plots

All fits created for a polar plot need to account for the polar coordinates. In a polar plot's fit equation, the X value is replaced with the angle value, and the Y value is replaced with the radius value. For example, the linear equation for a line/scatter plot is Y=B*X+A. In a polar plot, the linear equation is Radius = B*(Angle) + A.

Plot Page - Fit Plots

The fit plot properties **Plot** page contains the options to change the data and plot intervals, the number of points, and to generate statistics for the fit curve. To view and edit fit plot properties, click on the fit plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



The fit properties are displayed in the ***Property Manager*** *on the* ***Plot*** *tab.*

Plot Type

The *Plot type* property displays the type of plot.

Fit Direction

The *Fit direction* property sets whether the fit is added where Y is a function of X (*Y=F(X)*) or where X is a function of Y (*X=F(Y)*). The *Fit direction* property is not available for custom fit curves. Custom fit curves must be Y as a function of X.

Fit

The *Fit* section displays the fit curve equation and includes a command for editing the fit curve when a custom fit curve is selected.

Fit Type

Select the fit equation you wish to use in the *Fit type* list. Select one of the many predefined fit types or select a previously created custom fit. Click the Define Custom Fit command to create a new custom fit equation.

Fit Equation

The selected fit curve equation is displayed in the *Fit equation* box. This is the equation for the existing fit curve. When a predefined fit equation is selected in the *Fit type* field, the *Fit equation* is read-only information. When a custom fit equation is selected in the Fit type field, the *Fit equation* can be edited.

Name

When a custom fit equation is selected in the *Fit type* list, the *Name* property is available. The custom fit name is displayed in the *Name* field. You can edit the *Name* if desired.

Remove Fit from Types

Click *Remove* to remove the custom fit from this and all future *Fit type* lists. When the custom fit is removed, the *Fit type* becomes *Linear*.

Parameters

The *Parameters* section includes properties for improving or limiting the custom fit parameter values. By default, the initial guess is 0 and parameters are able to vary across the largest possible range, -1.79769×10^{308} to 1.79769×10^{308}.

Parameter

Select which parameter you wish to edit in the *Parameter* list. The selected *Parameter* initial guess, minimum, and maximum values are displayed.

Initial Value

Specify an initial guess for the parameter value in the *Initial value* field if you can. This is useful for ensuring Grapher finds the global best fit when the *Fit equation* is susceptible to local best fit values.

Minimum

Specify the *Minimum* value for the *Parameter* if the parameter value should have a lower bound. For example, if the parameter in your custom fit equation cannot be negative, set the *Minimum* to 0.

Maximum

Specify the *Maximum* value for the *Parameter* if the parameter value should have an upper bound. For example, if you know your parameter value cannot exceed 100, then type *100* in the *Maximum* field.

Fitted Plot

The *Fitted Plot* section defines the plot being fitted and which data in the plot should be fitted.

Plot

The *Plot* property displays the plot to which the fit is applied. This value is informational and cannot be changed.

Apply Fit to Entire Plot

The *Apply fit to entire plot* option uses all of the plot's data to determine the fit. Select the *Apply fit to entire plot* option to automatically set the *Minimum plot value to fit* and *Maximum plot value to fit* to the minimum and maximum extents of the plot. Clear the *Apply fit to entire plot* to specify a subset of the plot's data to fit.

When a single class is selected, *Apply fit to entire plot* will not force Grapher to fit data outside the selected class. Therefore, the fit curve statistics will not change. This can be used to quickly toggle between drawing the fit curve across the entire plot or only along the extents of the class. Typically, the Data Limits page is used to change where a plot is drawn.

Minimum and Maximum Plot Value to Fit

After the *Apply fit to entire plot* check box is cleared, the *Minimum plot value to fit* and *Maximum plot value to fit* properties are available. Specify a subset of the plot data to fit by typing values in the *Minimum plot value to fit* and *Maximum plot value to fit* fields. Press ENTER on the keyboard to make the change. *Minimum date/time* and *Maximum date/time* options are available if the appropriate data is formatted as date/time in the worksheet.

Class

A fit curve can be calculated for a specific class in a class plot. When a fit is added to a class plot, the *Class* property is available in the fit curve properties. To calculate the fit for only a single class, select the desired class in the *Class* list. To calculate the fit for all data, select *(All)*.

Running Average, *Weighted Average*, and *Spline Smoothing* fit curves cannot be added to class plots.

Plot Options

Some fit curves have specific options available to set. Spline smoothing, polynomial, orthogonal polynomial, running average, weighted average, LOESS, lognormal distribution, exponential PDF distribution, power PDF distribution, and inverse Gaussian distribution fits have options. All fits except weighted average and running average include the *Number of points* option.

Spline Smoothing

The *Spline smoothing* fit curve has a *Spline tension factor* option. The *Spline tension factor* value ranges from 1 to 50. Higher *Spline tension factor* values result in straighter lines between the data points. Lower *Spline tension factor* values result in more curvature to the fit line. To change the *Spline tension factor*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the spline tension factor value.

Polynomial and Orthogonal Polynomial

The *Polynomial* and *Orthogonal polynomial* fit curves have a *Polynomial degree* option. The *Polynomial degree* value ranges from 0 to 10. The default *Polynomial degree* is calculated based on the fitted data. A polynomial degree of zero is the average Y value. When the *Polynomial degree* value is one, the fit curve is a linear fit. Degree two is a quadratic fit, degree three is a cubic fit, and degree four is a quadric fit. To change the *Polynomial degree*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the polynomial degree value.

Running Average and Weighted Average

The *Running average* and *Weighted average* fit curves have a *Window width* option. The *Windows width* controls how many points are included when calculating the fit curve value at each data point. This number must be an odd number between 3 and 1001 for *Running average* fits and between 3 and 49 for *Weighted average* fits. The default window width of five averages the data point with the two values above the data point and the two values below the data point. An average of all five values is plotted as the point on the fit line. The fit is a line connecting these average points at each X data value. To change the *Window width*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the window width value.

The *Weighted average* fit curve also has a *Weights* section. The weights for the window can be set by expanding the *Weights* section and typing values for the *Order* properties. For example, if you have three points and want the middle point to have twice the weight of the other points, you would enter 1 for the weight of *Order 1*, 2 for the weight of *Order 2*, and 1 for the weight of *Order 3*. You can save the weights to a file by clicking *Save* in the *Save weights* field. Load weights from a file by clicking *Load* in the *Load weights* field. Orders are added or removed from the top and bottom of the weights list.

LOESS (LOWESS)

The *LOESS (LOWESS)* fit is defined by the *Span*, *Family*, and *Degree*. The *Span* is the proportion of the data used to fit the local polynomial at each point. The *Span* can vary between 0.1 (10%) and 1.0 (100%) of the data. Typically values between 0.25 and 0.5 are appropriate for the *Span* parameter. The *Span* is sometimes referred to as the smoothing parameter. The *Family* option determines the fit algorithm. When *Family* is set to *Gaussian*, a least squares fit is used. A redescending M estimator with Tukey's biweight or bisquare function is used to fit the data when *Family* is set to *Symmetric*. The *Degree* specifies the order of the local polynomials fit to each subset of the data. A *Degree* of *1 (Linear)* fits a linear function to each data subset. A *Degree* of *2 (Quadratic)* fits a quadratic function to each data subset.

Lognormal

The *Lognormal* fit curve has a *Location value* and *Scale value* option. The values can be any number. To change the *Location value* or *Scale value*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Click on the word *Custom* and select *Auto* box to return the values to the defaults.

Exponential PDF

The *Exponential PDF* fit curve has a *Scale value* option. The values can be any number. To change the *Scale value*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Click the word *Custom* and select *Auto* box to return the values to the defaults.

Power PDF

The *Power PDF* fit curve has a *Location value* and *Shape value* option. The values can be any number. To change the *Location value* or *Shape value*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Click the word *Custom* and select *Auto* box to return the values to the defaults.

Inverse Gaussian

The *Inverse Gaussian* fit curve has a *Location value* and *Shape value* option. The values can be any number. To change the *Location value* or *Shape value*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Click the word *Custom* and select *Auto* box to return the values to the defaults.

Number of Points

The *Number of points* option controls the number of data points used to draw the fit curve. A higher number of points result in a smoother line. A higher number of points will also take longer to generate the fit curve and update the graph. Regardless of how many points are used to draw the fit curve, all data points in the original plot inside the *Plot interval* are used to calculate the fit curve.

The *Number of points* can be any number between 2 and 2.14748e+9. To change the *Number of points*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the number of points.

The *Number of points*option is not available for running average and weighted average fit curves.

3D Settings

The *3D Settings* section is displayed for fit plots in the 3D graphs.

Position

The *Position* option controls the location of the plot on the depth axis of the 3D plot. For example, 0 percent places the plot at the front of the graph, 100 percent places the plot at the back of the graph, and 50 percent places the plot in the middle of the graph. To change the position, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the position of the plot.

Width

The *Plot width* controls the width of the plot. Plots can be 0.01 to 6 inches (0.025 and 15.24 cm) wide. To change the width, click on the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the width of the plot.

Line Frequency

Use the *Line frequency* field to control the cross lines along the plot width. The lines are usually drawn at each data point over the width of the plot, that is *Line frequency* is set to 1. When there are many points on the graph, the line color may overwrite most of the ribbon fill color. Use the *Linefrequency* option to skip lines on the plot. For example, if *Line frequency* is set to 5, every fifth line is plotted on the plot. To remove all of the lines, set the *Line frequency* to a number greater than the total number of data points. Up to 10,000 points may be skipped between lines. To change the *Line frequency*, click on the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the number of cross lines in the plot.

Statistics

The *Statistics* section has options for generating the statistics for the fit curve. To open the *Statistics* section, click the next to *Statistics*. There are three options for displaying the fit statistics. Click the *Copy* button next to the *Clipboard* option to copy the statistics to the clipboard. Once the statistics are copied to the clipboard, you can paste them into any program. Click the *Display* button next to the *Report* option to display the statistics in a pop-up report window. Click the *Insert* button next to the *Insert statistics* command to insert the fit statistics as a text object into the current plot.

If the plot has more than one fit curve and you wish to display or copy the statistics from all associated fits, select the plot and click the Copy All or Report All command.

Number Format

Select the number format for copied, displayed, or inserted statistics in the *Number format* list. Select *Compact* or *Fixed:*

- The*Compact* option displays numbers as fixed or exponential depending on the number set in the *Significant digits* box. For example, if the numeric format is set to *Compact* with two significant digits, 1447 shows as 1.4E+03. If the *Significant digits* are set to six, 1447 is displayed as 1447.
- The *Fixed* option displays numbers as dd.dd. Change theDecimal placesto show more or fewer numbers after the decimal character.

Editing Linked Statistics

Click the *Insert* button next to the *Insert statistics* command to insert the fit statistics as a text object into the current plot. The linked fit statistics text automatically updates as the fit parameters and data are changed.

The text that appears in the linked fit statistics can be edited. Click on the text in the **Object Manager** or plot window to select it. In the **Property Manager**, the text and the text properties are listed. To edit the text that is displayed, click the *Editor* button next to *Text* option. The Text Editor opens. You can add text by typing in the box. The linked equation and statistics that are displayed will update when the fit curve changes.

To unlink the text from the fit curve, click on the text to select it. In the **Property Manager**, click the button next to the *Text* option. In the **Text Editor**, select the fit name from the *Fit* list and select *No fit selected*. Click *OK* and the text becomes unlinked from the fit curve, displaying only the fit statistic property names.

Add to Graph

The *Add to Graph* section includes a command for adding a confidence interval to the graph.

Confidence

Click the *Add Interval*button next to the*Confidence*command to add a confidence interval to your data set. The confidence plot is automatically created. Click on the confidence plot in the **Object Manager**or in the plot window to edit the confidence plot properties.

Confidence intervals are not available for the spline smoothing, running average, weighted average, and LOESS (LOWESS) fits.

Fit Statistics

Most fit statistics include the following information. The information in the << >> text is the name that should be used when linked text is desired.

Fit Name

The fit name can be changed through the Object Manager or by right-clicking on the selected fit then choosing **RenameObject** from the menu. Use <<FitName>> to link the fit name in the text.

Data Source Plot

The data source plot is listed in the fit Plot page. The data source plot is the plot to which the fit is applied. Use <<SourcePlot>> to link the data source plot name in the text.

Fit Equation

If a fit has an equation it is displayed in the fit statistics. See Available Fits for more details. Use <<Equation>> to link the fit equation in the text.

Alternate Equation

Alternate equations are provided for power and exponential fits. See Available Fits for more details. Use <<AltEquation>> to link the alternate fit equation in the text. When the equation has no alternate, the text *No alternate equation*is shown.

Number of Data Points Used

This section displays the number of data points used in the fit calculation. Use <<NumberOfPts>> to link the number of points used in the text.

Average X

Average X is displayed for most fits. Some fits display the average natural log of X (lnX). Use <<AvgX>> to link the average X value to the text.

Average Y

Average Y is displayed for most fits. Some fits display the average natural log of Y (lnY). Use <<AvgY>> to link the average Y value to the text.

Residual Sum of Squares

The residual sum of squares (SSe) is the sum of the squares of all the residual values. A residual is the difference between the fit Y values and the actual Y data values at given X values. Use <<RSS>> to link the residual sum of squares to the text.

Regression Sum of Squares

The regression sum of squares (SSr) is the sum of the squares of the difference between the average of all Y values and the fit Y value at each X location where a data point occurs. Use <<RGSS>> to link the regression sum of squares to the text.

Coefficient of Determination

Coefficient of determination, R-squared shows how well the data are explained by the best-fit line.

$$r^2 = 1 - \frac{SSe}{SSe + SSr}$$

When using a *Through origin* fit, R-squared is calculated with

$$r^2 = 1 - \frac{SSe}{Syy}$$

where Syy is the sum of y * y.

Use <<R2>> to link the R-squared value to the text. When multiple degrees to a polynomial fit are specified, use <<R2_n>> where n goes from 0 to the degree of the polynomial fit.

Correlation Coefficient

The correlation coefficient, R, shows the strength and direction of the linear relationship between to variables.

$$r = \frac{\sum x_i y_i - n\bar{x}\bar{y}}{\sqrt{\sum x_i^2 - n\bar{x}^2}\sqrt{\sum y_i^2 - n\bar{y}^2}}$$

The correlation coefficient is also the square root of the coefficient of determination, R-squared.

Use <<R>> to link the R value to the text. When multiple degrees to a polynomial fit are specified, use <<R_n>> where n goes from 0 to the degree of the polynomial fit.

Residual Mean Square

The residual mean square, sigma-hat-sq'd equation is:

$$\hat{\Sigma}^2 = \frac{SSe}{n-2}$$

where n = the number of Y values for the curve on which the fit is based.

Use <<RMS>> to link the residual mean square value to the text.

P-Value

The P-value is the probability of finding the observed results when the null hypothesis is true. For the regression methods, the P-value tests the null hypothesis that the coefficient is equal to zero. In Grapher, the P-value is calculated using the Student's t test.

Use <<PValue>> to link the P-Value to the text.

Standard Deviation

The standard deviation is calculated for the normal distribution (Gaussian) fit. The normal distribution (Gaussian) fit is an option for the 2D

Histogram and 3D XYY Histogram plots. The standard deviation of a sample is the square root of the variance of the sample.

$$s = \sqrt{\frac{1}{(n-1)}\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

where

n is the number of observations	x^i is the data value	$\bar{x}$ is the mean

Use <<SD>> to link the standard deviation to the text.

Coefficients

The coefficients for each fit are displayed in the fit equation.

Standard Error of Coefficients

The standard deviation of an estimate is the standard error. The standard error of the coefficient is a measure of the precision of the estimate. The standard error of the intercept (A) estimate is displayed as the *Standard error of intercept (A)*, and the standard error of the slope (B) estimate is displayed as the *Standard error of slope (B)* in the fit statistics. Use <<StdErrorX>> to link the standard error of the intercept to the text. Use <<StdErrorY>> to link the standard error of the slope to the text.

Orthogonal Polynomial Factors

Orthogonal polynomial regression statistics include X Shift, Y Shift, B[n], Alpha[n], and Beta[n]. Please see Orthogonal Polynomial Regression for more details on the use of these factors.

Use <<PolyDegree>>, <<XShift>>, <<YShift>>, <<B_n>>, <Alpha_n>>, <<Beta_n>> to link these values to the text. Where n is indicated, use the value between 0 and the largest polynomial degree.

Histogram Fit Statistics

Histogram fit curves display shape parameters, scale parameters, and location parameters. Different fit types have different parameters listed. Refer to the Available Fits page for the equations used for each fit type and which parameter is the shape, scale, or location parameter.

Use the above options to display the same information for histograms. In addition, use <<COEFF_0>>, <<COEFF_1>>, <<COEFF_2>>, for the Scale, Shape, Location, and Goodness of fit parameters.

Histograms also have a Goodness of Fit statistic. This value shows how likely the selected distribution type fits the data. **Grapher**uses an Anderson-Darling method to calculate the Goodness of Fit statistic. The value calculated and displayed in the fit statistics should be compared to critical values for the data.

For further information about fit statistics, please refer to the references or refer to any statistics book.

Statistics References

Gilbert, Richard O. (1987) *Statistical Methods for Environmental Pollution Monitoring*. New York: Van Nostrand Reinhold.

Hildebrand, David K. (1986) *Statistical Thinking for Behavioral Scientists.* Duxbury Press.

Hines, William W. and Douglas C. Montgomery. (1980) *Probability and Statistics in Engineering and Management Science*, 2nd edition, New York: John Wiley and Sons.

King, Ronald S. and Bryant Julstrom. (1982) *Applied Statistics Using the Computer*. Sherman Oaks, California: Alfred Publishing Company.

Press, William H. et al. (1992) *Numerical Recipes in C: The Art of Scientific Computing*. New York: Cambridge University Press.

Sheskin, D.J. (2000) *Handbook of Parametric and Nonparametric Statistical Procedures, Second Edition.* Boca Raton, Florida: Chapman & Hall/CRC.

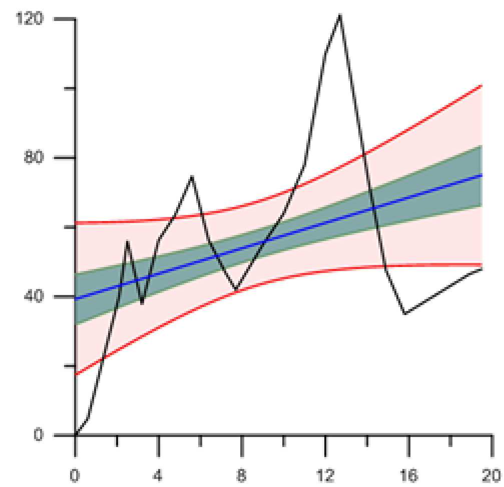
Sokal, Robert R. and F. James Rohlf. (1981) *Biometry: Principles and Practices of Statistics in Biological Research*. New York: Freeman and Co.

Spiegel, Murry R. (1961) *Schaum's Outline of Theory and Problems of Statistics*. New York: McGraw-Hill Inc.

Zar, Jerrold H. (1974) *Biostatistical Analysis*. Englewood Cliffs, New Jersey: Prentice Hall.

Confidence Intervals

Confidence intervals provide an estimated range of values calculated from a given set of data that is likely to include an unknown population parameter. A very wide confidence interval suggests that more data should be collected before anything definite can be said about the unknown parameter.



This graph shows a line plot in black, linear fit curve in blue, and two confidence intervals in red and green.

In statistics, a confidence interval or confidence bound is an interval estimate of a population parameter. Instead of estimating the parameter by a single value, an interval likely to include the parameter is given. Thus, confidence intervals are used to indicate the reliability of an estimate. How likely the interval is to contain the parameter is determined by the confidence level or confidence coefficient. Increasing the desired confidence level will widen the confidence interval.

This option is not available for the LOESS, spline smoothing, running average, and weighted average fits.

Adding a Confidence Interval to a Fit

To add a confidence interval to a fit:

1. Select a fit.
2. Click the **Plot** tab in the Property Manager.
3. Click the *Add Interval*button next to the *Confidence* command. A confidence interval is added to the selected fit.

Editing Confidence Interval Properties

To change the features of a confidence plot, including the level and the number of iterations, open the confidence level properties by selecting the confidence level and editing the properties in the **Property Manager**.

You can change the following confidence properties:

Plot

Data Limits

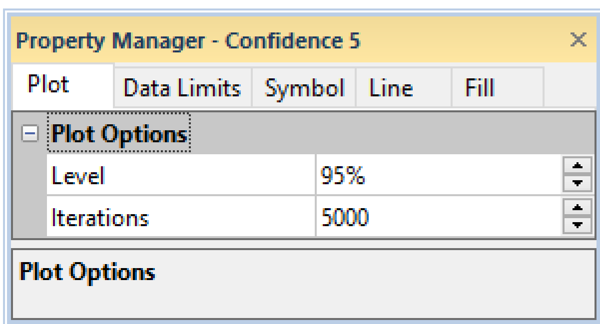
Symbol

Line

Fill

Plot - Confidence

To view and edit the confidence plot properties, click on the confidence plot in the Object Manager or plot window. Click on the **Plot** tab in the Property Manager. You can then change settings for a selected confidence interval in the document.



*Set the confidence interval Level and Iterations on the **Plot** tab of the **Property Manager**.*

Plot Type

The *Plot type* property displays the type of plot.

Level

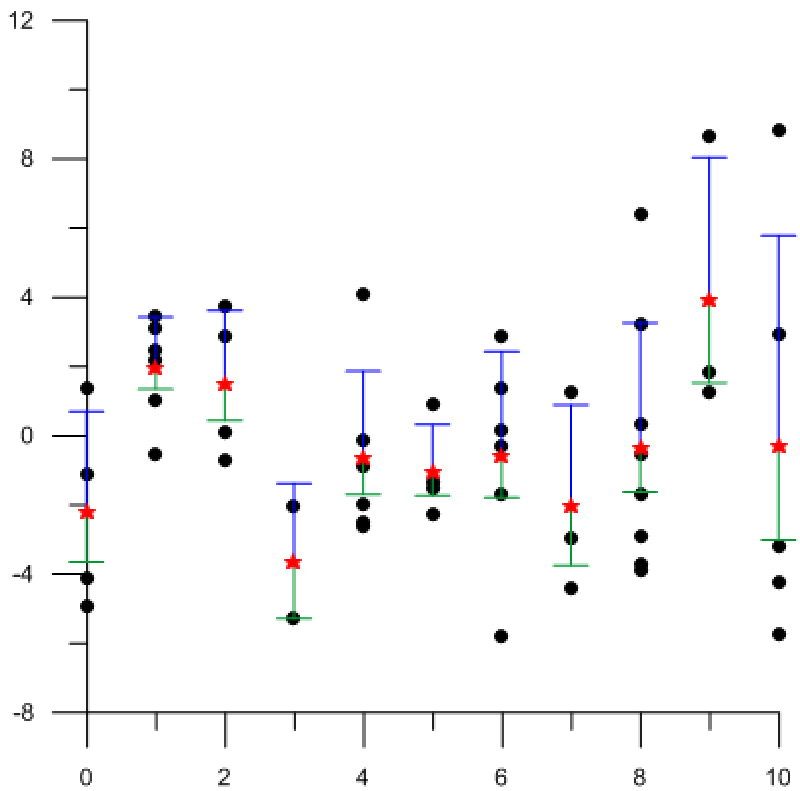
The *Level* indicates the amount of confidence that a fit curve will appear inside the confidence area. To change the confidence interval *Level,* highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value. Increasing the confidence *Level* will widen the confidence interval. The confidence interval *Level* value must be between 50 and 99.99.

Iterations

The *Iterations* value is the number of times the program will try to attempt to create a set of fit curves to plot as the confidence interval. To change the number of iterations to calculate, highlight the existing number next to the *Iterations* option and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the number of iterations. The *Iterations*value is a number between 100 and 1,000,000.

Error Bars

Error bars can be displayed on line plots, scatter plots, line/scatter plots, horizontal bar charts, vertical bar charts, 3D ribbon plots, 3D wall plots, 3D horizontal bar charts, and 3D vertical bar charts. You can display error bars for the average value, sample standard deviation, population standard deviation, or standard error of the mean. Also, custom error bars can be calculated in the data file and displayed on the plot. Different positive and negative error bars can be displayed on the plot. It is best to display the original data as symbols rather than as a line when displaying error bars.



This scatter plot displays vertical error bars, showing the sample standard deviation in the positive direction (blue) and standard error of the mean in the negative direction (green). The red symbols are the average values.

The selected plot properties, including the **Error Bars** tab, appear in the Property Manager.

Direction

The *Direction* property specifies which error bars are displayed. Display vertical error bars when there are multiple Y values for each X value.

Display horizontal error bars when there are multiple X values for each Y value. Display both vertical and horizontal error bars if you have calculated errors in both X and Y for the points in the scatter plot. You must use error values from a data column to display error bars in both directions. Even when no error bars are displayed, an average value can be displayed in the plot.

- Select *None* to not display error bars in the plot. A bar or symbol at the average value can still be included when no error bars are displayed.
- Select *Vertical* to display vertical error bars.
- Select *Horizontal* to display horizontal error bars.
- Select *Vertical and Horizontal* to display error bars in both directions. The *Properties to edit* field contains *Vertical error bars* and *Horizontal error bars*.

Properties to Edit

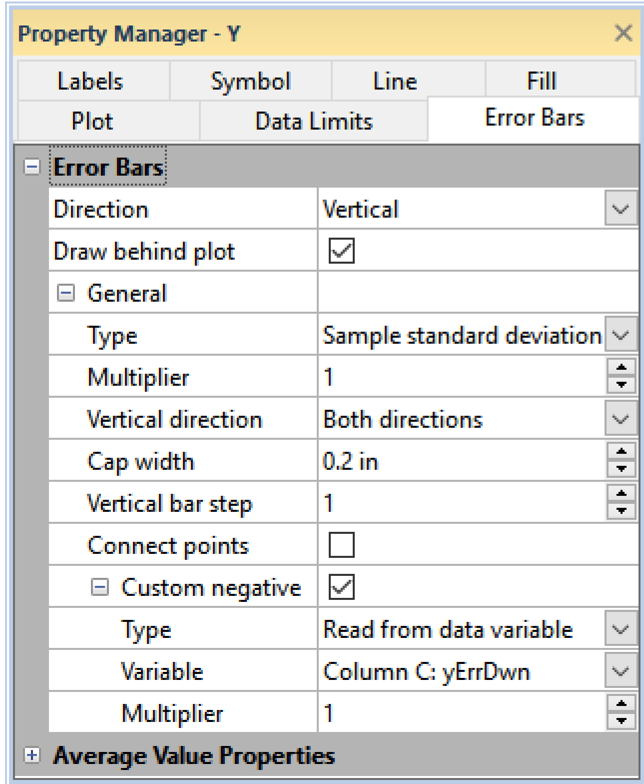
The *Properties to edit* field controls which properties are displayed in the **Property Manager**. The *Properties to edit* list is only displayed when the *Direction* property is set to *Vertical and Horizontal*

Draw Behind Plot

Select the *Draw behind plot* property to draw the error bars, average value symbol, fill between the error bar lines, and connecting lines behind the plot in the draw order. Clear the *Draw behind plot* property to draw error bars, average value symbols, and connecting lines on top of the plot.

Error Bars Properties

The following error bars properties are displayed when *Direction* is set to *Vertical*, *Horizontal*, or *Vertical and Horizontal*.



*Edit the error bar properties on the **Error Bars** page.*

Error Bar Type

The error bar *Type* can be set to *Read from data column*, *Average value only*, *Sample standard deviation*, *Population standard deviation*, or *Standard error of the mean*. To change the *Type*, click on the current option and select the desired option from the list.

- If custom error bars have been calculated in the worksheet, set the *Type*to*Read from data column* to display the custom values. Then, set the *Column*. *Read from data column* is the only option when displaying both vertical and horizontal error bars.
- Select *Average value only* to display the average Y value for each X value for vertical error bars or the average X value for each Y value for horizontal error bars.
- Select *Sample standard deviation* to show the sample standard deviation of the Y values for each X value for vertical error bars or the X values for each Y value for horizontal error bars. The *Sample standard deviation*calculates the standard deviation of the subset sampled points.
- Select *Population standard deviation* to show the population standard deviation of the Y values for each X value for vertical error bars or the X values for each Y value for horizontal error bars. The

Population standard deviation calculates the standard deviation for the entire set of points.

- Choose *Standard error of the mean* to display the standard error of the mean of Y values for each X value for vertical error bars or the X values for each Y value for horizontal error bars.

When negative error bars are displayed separately from positive error bars, this *Type* is for the positive direction only.

Column

Select the data column containing the error values in the *Column* field. When *Read from data column* error bars are used, error bars are displayed for every data row that has a value in the selected *Column*.

To change the *Column*, click the current column and select the desired column in the list.

Note: this column should contain error values and not the data value plus or minus the error value. For example, in one sample the freezing point of a mixture is determined to be 1.6 degrees Celsius and error is determined to be 0.2 degrees Celsius. The value in the error column should be 0.2 degrees, not 1.4 and/or 1.8 degrees Celsius. The error value (0.2) should be in the same worksheet row as the data value (1.6).

Multiplier

The *Multiplier* multiplies the length of the error bar by the number entered into the *Multiplier* box. For example, if a standard deviation error bar is multiplied by two, two standard deviations are displayed on the error bar. The *Multiplier* value can be any number from 0.01 to 10.0. To change the *Multiplier*, highlight the existing value and type the new value. Alternatively, click the  to increase or decrease the *Multiplier*value. Press ENTER on the keyboard to make the change.

Error Bar Directions

Error bars can be displayed multiple ways. You can select the direction the error bars are displayed in the *Vertical direction* or *Horizontal direction* field. To change the *Vertical direction* or *Horizontal direction*, click on the current option and select the desired option from the list.

- *Both directions* displays the error bars in the increasing and decreasing directions. For example, if the error bar is a sample standard deviation error bar, selecting *Both directions* shows the standard deviation on both sides of the mean. The *Custom negative* option is only available when the *Direction* is set to *Both directions*.

- *Positive direction* displays the error bar in the increasing axis direction only.
- *Negative direction* displays the error bar in the decreasing axis direction only.
- *Away from zero* plots error bar caps pointing away from zero. These error bars can be positive or negative.
- *Towards reference* plots error bar caps pointing toward zero. These error bars can be positive or negative.

Cap Width

You can change the width of the bar cap by changing the number in the *Cap width* box. The *Cap width* is the width, in page units, of the cap at the end of the error bar. The *Cap width* value can be any number between 0.0 and 5.0 inches (0.0 and 12.7 centimeters). To change the *Cap width*, highlight the existing value and type a new number. Alternatively, click the to increase or decrease the *Cap width*. Press ENTER on the keyboard to make the change.

Bar Step

Use the *Verticalbar step* or *Horizontal bar step* option to skip error bars in the plot. For example, if the *Verticalbar step* is set to five, every fifth vertical error bar is plotted on the graph. To change the *Vertical bar step* or *Horizontal bar step* value, highlight the existing value and type a new number. Alternatively, click the to increase or decrease the *Vertical bar step*or*Horizontal bar step*. Press ENTER on the keyboard to make the change.

Connect Points

Select the *Connect points* option to connect the tops and bottoms of the error bars with a line. Clear the box to show error bars individually and not connected. This option is not available for 3D plot types. The connection line properties are located in the Line page *Error Bar Connection Line* section.

Custom Negative Error Bars

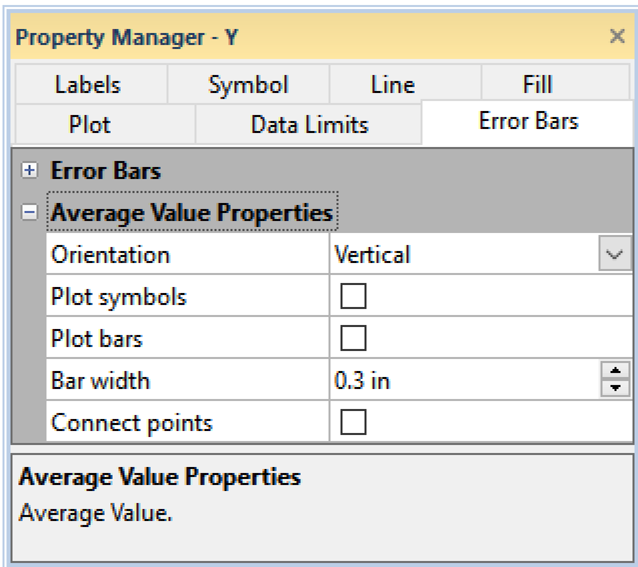
Check the box next to *Custom negative* to define error bars in the positive and negative direction separately. Click the next to *Custom negative* to set the negative error bar properties. The *Type, Column*, and *Multiplier* become available for the negative direction. The custom negative error bar options are most useful when the error is asymmetrical and therefore different in the positive and negative direction.

Export Error Bar Values

To export error bar values, click on the plot to select it. Click the Graph Tools | Plot Tools | Export Data command. A worksheet is created with the X values, vertical error bar deviations, and vertical average value or Y values, horizontal error bar deviations, and horizontal average value for each error bar in the plot.

Average Value Properties

The *Average Value Properties* are displayed after the error bar properties in the **Property Manager**.



*Edit the average value properties on the **Error Bars** page.*

Orientation

When the *Direction* is set to *None*, the *Orientation* must be specified to display average value bars or symbols. Set the *Orientation* to *Vertical* to display a bar or symbol at the average Y value for each X value. Set the *Orientation* to *Horizontal* to display a bar or symbol at the average X value for each Y value. The average value bar orientation is determined by the error bar direction when error bars are displayed on the plot.

Plot Average Symbols

You can show average data values with a symbol or a bar. To display a symbol, select the*Plot symbols*option. The default symbol is displayed at the average value. To change the average value symbol properties, click the Symbol tab and edit the *Average Value Symbol Properties*.

Plot Average Bars

You can show average data values with a symbol or a bar. Select the *Plot bars* option to display a bar at the average data value. The average bar line has the same line properties as the entire error bar. The line properties are set in the *Error Bar Line Properties* section of the Line page.

Average bars can also be displayed by selecting *Average value only* for the *Type* in the *Vertical error bars* or *Horizontal error bars* properties.

Bar Width

The width of the average bar can be changed with the *Bar width* option. The average bar width can be any number between 0.0 and 5.0 inches (0.0 and 12.7 centimeters). To change the width, highlight the existing value and type a new value. Alternatively, click on the  to increase or decrease the width of the average bar. Press ENTER on the keyboard to make the change.

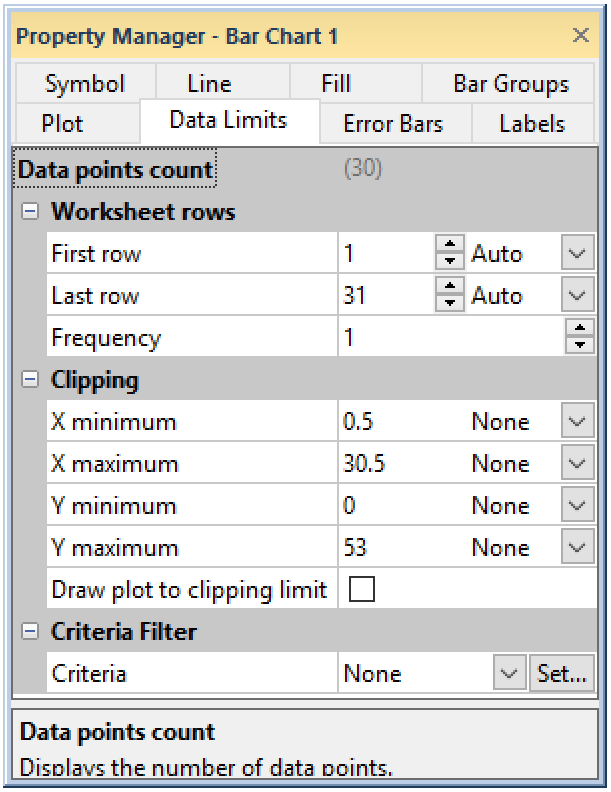
Connect Average Values

Select the *Connect points* option to connect the average values with a line. Clear the box to remove the average value connecting line. Edit the connecting line properties in the *Error Bar Line Properties* section of the Line page.

Clipping

Data Limits Properties

Data limits properties are used to limit the data appearing in many types of plots in **Grapher**. Data can be limited on the input side by *Worksheet rows*, *Plot Interval*, or *Value Limits*, and *Criteria* filtering, and the plot appearance can be limited on the output side by *Clipping*. Select the plot you wish to limit and click the **Data Limits** tab in the Property Manager to edit the data limits properties.



*Change the input data filtering and plot clipping properties in the **Property Manager** on the **Data Limits** tab.*

Data Points Count

The total number of data points used in the plot appears next to the *Data points count* field. This value changes as the *First row, Last row,*and*Frequency* changes. This value is informational and cannot be changed directly.

Worksheet Range

Select the data range to plot in the *Worksheet range* section. The default data range includes the first and last rows/columns in the worksheet that contain data. If *Data in rows* is selected on the **Plot** page, the worksheet range is specified by column rather than row.

If *Auto* is selected for the *First row* and *Last row*, all of the rows containing data are used. Click the word *Custom* and select *Auto* to go back to automatic row selection. The word *Auto* will appear and the *First row* or *Last row* will revert to the default row.

To limit the range of the plotted data, you can change the range of rows. Type a new row number into either the *First row* and *Last row* boxes. To change the value, either highlight the existing row number and type a new row number or click the  to scroll to a new row number. Press ENTER on the keyboard to update the plot. The *Auto* selection will automatically update to *Custom*.

Use the *Frequency* to skip rows of data in the plot. For example, if *Frequency* is set to 5, every fifth data value between the *First row* and *Last row* is plotted on the plot. When *Frequency* is set to 1, every data value between the *First row* and *Last row* is displayed.

Stiff Plot Worksheet Rows

The worksheet rows are specified for the left side and right side of a stiff plot independently in the *Left rows* and *Right rows* sections.

Clipping

The *Clipping* section sets the limits of the data displayed on the graph. Plots can be clipped to the axis limits or to custom values. When a plot is clipped, the plot is not drawn outside a specific range of values. At least one data point must be within the clipping limits for Grapher to draw the plot.

Setting the clipping limits to *Axis* is useful for quickly viewing a section of the plot by changing the Axis limits. Setting the clipping limits to None always displays the entire plot, regardless of the axis limits. Setting the clipping limits to a custom value can be useful for removing unwanted data from the plot.

Clipping Limits

To change the custom clipping value, highlight the existing number in the *X minimum*, *X maximum*, *Y minimum*, *Y maximum*, *Z minimum*, *Z maximum*, *Radius minimum, Radius maximum, Angle minimum, and Angle maximum* box and type a new value. Press ENTER on the keyboard to accept the new value and update the plot. If the custom value is set to a number that is less than the minimum data value or greater than the maximum value, all of the data is displayed.

Set the *X minimum*, *X maximum*, *Y minimum*, and *Y maximum* to *None*, *Custom*, or *Axis*. For polar plots, set the *Radius minimum*, *Radius maximum*, *Angle minimum*, and *Angle maximum* values. 3D plots also contain *Z minimum* and *Z maximum* options.

- Click the word to the right of the value and select *None* to accept the full data range.
- Click the word to the right of the value and select *Axis* to clip the

data to the axis limits. If the plot is displaying more data than desired, change the *Axis limits* on the Axis tab.

- Click the word to the right of the value and select *Custom* to limit the plot to a specific range.

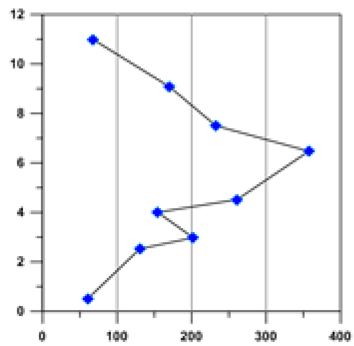
Values can also be typed directly into the *X minimum, X maximum, Y minimum, Y maximum, Z minimum, Z maximum, Radius minimum, Radius maximum, Angle minimum*, or *Angle maximum* boxes. When the value is changed directly, the type of clipping automatically changes to *Custom*.

Custom Date/Time Values

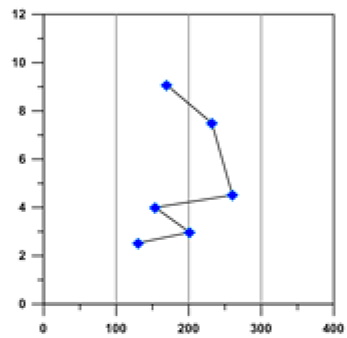
If you have used date/time formatted values to create a graph, date/time tick labels are automatically enabled for that axis. If you select *Custom* for the *X minimum*, *X maximum*, *Y minimum*, *Y maximum,Z minimum,* or *Z maximum* options, you can set the clipping range by dates or time. For example, if date/time data are used for the X values of a plot, *X minimum date/time* and *X maximum date/time* fields are available. Click the current date/time value next to *X minimum date/time* and *X maximum date/time* to open the Select Date/Time dialog. Set a new date and time and click *OK* to return to the **Property Manager**. Alternatively, highlight the date/time value next to *X minimum date/time* or *X maximum date/time* and type the desired date or time value. Press ENTER on the keyboard to update the plot. When inputting date/time values directly in the **Property Manager**, date/times must always be entered as MM/dd/yyyy hh:mm:ss. No other formats are permitted in the date/time edit boxes in the **Property Manager.**

Draw Plot to Clipping Limit

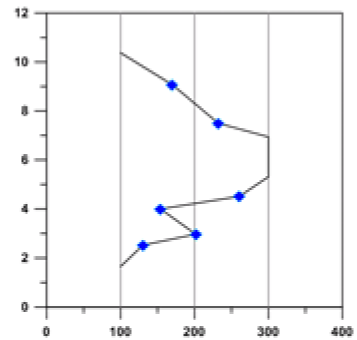
When a plot is clipped, the lines in the plot are drawn connecting the visible data. When the *Draw plot to clipping limit* box is checked, the shape of the line reflects data outside the clipping limits and the line is drawn to the extents of the clipping limits. For example, if you clip a line/scatter plot to a minimum of 100 and a maximum of 300, but the data appear at a minimum of 125 and a maximum of 255 within these limits, the line is limited to 125 to 255. Check the *Draw plot to clipping limit* box to draw a line to the extents of the clipping limits, in this case, 100 to 300.



The original plot is shown without clipping.

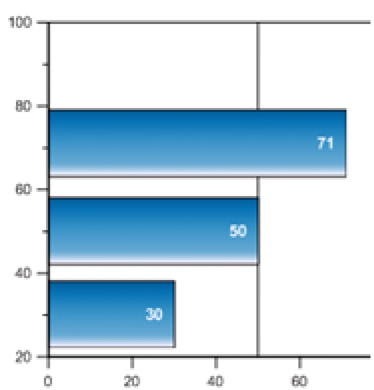


The X axis clipping is set to a range of 100 to 300. The X axis range is 0 to 400. The Draw plot to clipping limits *option is not checked. The line is drawn between the visible, unclipped points, as if the clipped points did not exist in the data table.*

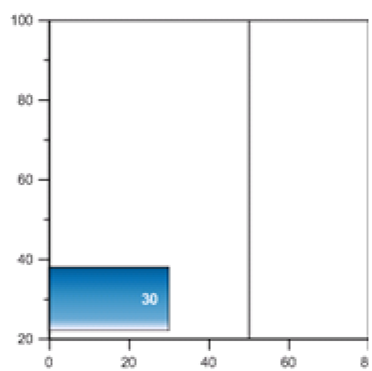


The X axis clipping is set to a range of 100 to 300. The X axis range is 0 to 400. The Draw plot to clipping limits *option is checked. The line extends to 100 and 300. The shape of the line changes to reflect outlying clipped points.*

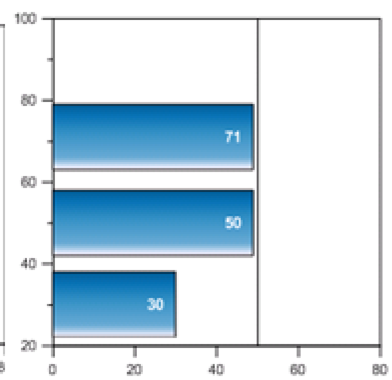
For a bar chart, if the *Draw plot to clipping limit* is checked, the bar is displayed extending to the clipping value. If the box next to *Draw plot to clipping limit* is not checked, the bar is removed from the plot.



This bar chart displays all of the bars without any clipping. The label displays the X value being plotted in all these bar charts.



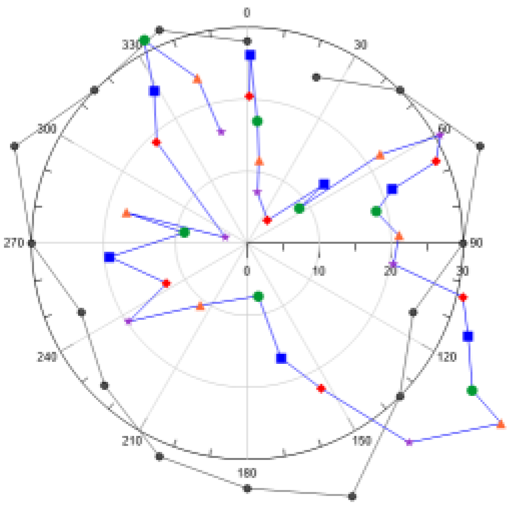
This bar chart is clipped to a maximum X value of 49. The Draw plot to clipping limit*is not checked, so the clipped bars are completely removed.*



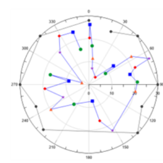
This bar chart is clipped to a maximum X value of 49. The Draw plot to clipping limit*is checked, so the clipped bars are displayed to the clipping value.*

Clip Plot to Polar Circle

For polar plots, when the *Clip to polar circle* box is checked, points outside the Angle axis are not drawn. These points are completely removed from the polar plot. When the*Clip to polar circle*command is not checked, the plot can extend beyond the Angle axis.



This plot has points outside the Angle axis and no clipping



*This plot has the*Clip to polar circle *option checked. The points outside the Angle axis are removed. In this example the* Missing data *property is* Continuous plot*, so the lines are redrawn connecting the remaining points.*

Data Criteria

The *Criteria* setting allows you to specify filtering criteria for excluding data from a plot. Data can be excluded by specifying values to ignore, *NULL criteria*, or only certain data can be included by specifying to use only data that matches specified value(s) in a column, *Column criteria*. Click the *Set*button next to *Criteria* to open the **Criteria** dialog where you can specify the custom criteria. After specifying the criteria in the **Criteria** dialog, the *Criteria* property is updated to display the criteria filter type.

Fit Plot Interval

The *Plot interval* section controls the limits of the fit curve. The *Plot interval* can extend the fit curve beyond the data limits of the original plot. Click the ⊞ next to the *Plot interval* option to open the section. The Plot interval section only controls the values where the fit curve is displayed.

The Plot interval does not change which data is fitted. To create the fit curve from only a subset of the plot data, use the Fitted plot properties on the fit curve Plot page.

Plot Limits

ThePlot limitsoption sets how the limits for the fit curve are chosen. The *Fitted data limits* option uses the *Minimum value* and *Maximum value* from the Plot page *Fitted plot* section for the *Minimum plot value to fit* and *Maximum plot value to fit* values. The *Axis limits* option extends the fit plot to the entire axis range. When the axis limits are changed, the fit curve is automatically changed to fit the new axis limits. The*Custom* option allows custom values to be set for the *First X* and *Last X* values. To change the *Plot limits*, click on the current option. Select the new option from the list and the plot will automatically update.

If the custom fit range is greater than the axis limits and the axis is set to use automatic limits, the axis range changes to match the customized limits. If the axis limits are set to custom limits, the fit curve can exceed the axis area if the *First X* or *Last X* value is outside the axis range.

To change the *First X* or *Last X* values, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change.

The running average, weighted average, and spline smoothing fits do not extrapolate the fit beyond the data. Regardless of the values in the *Plot interval* section, the fit curve will not plot beyond the original plot's X range.

Function Value Limits

Specify the function interval, or range of the variable, in the *Value Limits* section. The *First value* and *Last value* properties specify the beginning and end of the function plot. To change the value, highlight the existing value and type the new value. Press ENTER on the keyboard to make the change. Enter the first value for the independent variable into the *First value* box. Enter the last value for the independent variable into the *Last value* box.

Number of Points and Increment

The *Number of points* determines how many times the equation is calculated. This determines the number of plotted data points. A larger number of points means more detail is plotted in the function. However, the larger the number of points, the longer it will take to graph the function. When the *Number of points* is changed, the *Increment* value is automatically updated. The *Increment* value shows the difference in the independent variable (X, Y, A, or T depending on function *Type*) values between adjacent points on the graph. When the *Increment* value is changed, the *Number of points* is automatically updated. The *Number of points* cannot exceed 1000.

Grid Rows

Select the number next to *First row* to change the number of the first row to be used in the map. This value cannot exceed the number of rows in the grid file. Select the number next to *Last row* to change the number of the last row to be used in the map. This value cannot exceed the number of rows in the grid file.

If *Auto* is selected for the *First row* and *Last row*, all of the rows containing data are used. To limit the range of the plotted data, you can change the range of rows. Next to *First row* or *Last row,* click the word *Auto* and select *Custom*. You can then enter a new row number into either the *First row* and *Last row* boxes. To change the value, either highlight the existing row number and type a new row number or click the to scroll to a new row number. Press ENTER on the keyboard to update the plot.

Click the word *Custom* and select *Auto* to go back to automatic row selection. The word *Auto* will appear and the *First row* or *Last row* will revert to the default row.

Select the number next to *First column* to change the number of the first column to be used in the map. This value cannot exceed the number of columns used in the grid file. Select the number next to *Last column* to change the number of the last column to be used in the map. This value cannot exceed the number of columns used in the grid file.

If *Auto* is selected for the *First column* and *Last column*, all of the columns containing data are used. To limit the range of the plotted data, you can change the range of columns. Next to *First column* or *Last column,* click the word *Auto*. It will change to *Custom*. You can then enter a new column number into either the *First column* and *Last column* boxes. To change the value, either highlight the existing column number and type a new column number or click the to scroll to a new column number. Press ENTER on the keyboard to update the plot.

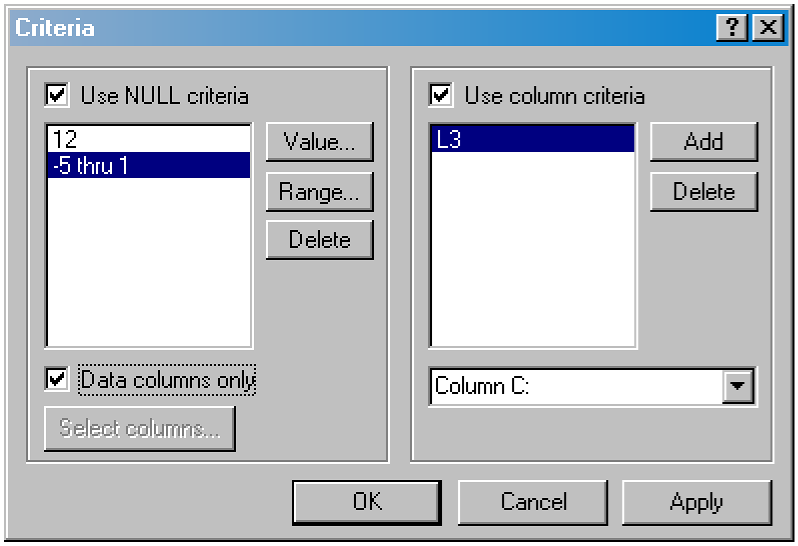
Click the word *Custom* to go back to automatic column selection. The word *Auto* will appear and the *First column* or *Last column* will revert to the default column.

Criteria

The **Criteria** dialog provides two ways of excluding data that you do not want to display on a plot.

Criteria Dialog

To open the **Criteria** dialog, click on an existing plot. In the Property Manager, click on the Clipping tab. Click on the *Set* button next to the *Criteria* command.



*Use the **Criteria** dialog to exclude data that you do not want to plot.*

Null Criteria

A null value is a value that is treated as missing data. For example, if the number -9999 indicates no data in your data file, it is usually treated as a valid number when plotting graphs. By checking the *Use NULL criteria* option, you can indicate that -9999 should be treated as a null field so these values are not plotted on the graph.

To treat a number as a null value:

1. Click on a plot to select it.
2. In the **Property Manager**, click on the **Data Limits** tab.
3. Check the box next to the *Use criteria* command.
4. Click the *Set*button next to the *Criteria* command to open the **Criteria** dialog.
5. Check the box next to the *Use NULL criteria* option.
6. Click the *Value* button. The Enter NULL Value dialog opens.
7. Type a number in the *NULL Value*box and click *OK*.

8. Click *OK* in the **Criteria** dialog to return to the plot. The points with the *NULL value*will not be drawn on the plot.

To treat a data range as null values:

1. Click on a plot to select it.
2. In the **Property Manager**, click on the **Data Limits** tab.
3. Check the box next to the *Use criteria* command.
4. Click the *Set*button next to the *Criteria* command to open the **Criteria** dialog.
5. Check the box next to the *Use NULL criteria* option.
6. Click the *Range* button.
7. Type a low and high value in the Range dialog and click the *OK* button.
8. Click the *OK* button in the **Criteria** dialog to return to the plot.

You can add several values as null values. Letters (a-z), numbers with symbols (e.g., 50%), and rows containing blank cells are not treated as numbers and are not plotted on a graph.

Specifying Data Columns

By default, only the plotted data columns are used when determining if a point should have the null criteria applied. To use additional columns, clear the *Data columns only* box. Click the *Select columns* button and select columns to check for null values.

Column Criteria

The column criteria method is a way to select data based on entries in an additional column. For example, a data file has five sampling locations labeled L1 through L5. To create a plot containing only the third sampling location, L3, you would use column criteria. Numeric values and text may be used as column criteria.

To use column criteria:

1. Click on a plot to select it.
2. In the **Property Manager**, click on the **Data Limits** tab.
3. Check the box next to the *Use criteria* command.
4. Click the *Set*button next to the *Criteria* command to open the **Data Limits** dialog.
5. Check the *Use column criteria* box.
6. Click the *Add* button. The Enter Criteria Value dialog appears.

7. Type the criteria value into the **Enter Criteria Value** dialog and click the *OK* button.
8. Click the *OK* button in the **Criteria** dialog to return to the plot.

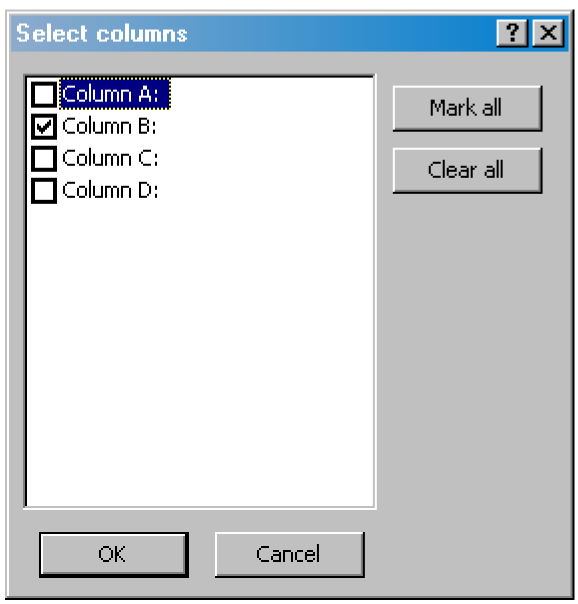
Criteria Tips

Both null and column criteria can be used together in a single plot.

If no data plots after you click the *OK* button in the **Criteria** dialog, check the columns for the null criteria to ensure that only the appropriate columns are selected, or check the data file to ensure that the column criteria value is in the worksheet.

Select Columns

The **Select columns** dialog displays when the *Data columns only* box is unchecked in the Criteria dialog. Click the *Select columns* button in the **Criteria**dialog to open the **Select columns** dialog. The **Select columns** dialog contains all of the columns used in the current worksheet.



*Select columns from the worksheet in the**Select columns**dialog.*

Mark All

Click the *Mark all* button to check all of the columns. A checked box next to a column indicates that the column is used for NULL criteria selection.

Clear All

Click the *Clear all* button to uncheck all of the columns. An unchecked box next to a column indicates that the column is not used for NULL criteria selection.

Individually Select/Deselect

Columns may also be selected or deselected individually by clicking in the boxes preceding the name of each column. Only check the boxes next to the columns that should be used for defining the NULL criteria. For instance, in the example above, only column B will be used to determine if a data point should be checked for a NULL value.

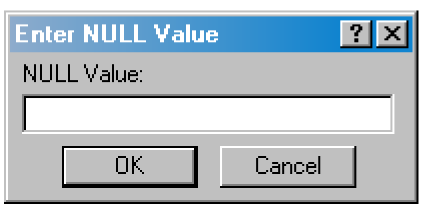
Click *OK* to return to the **Criteria** dialog with the column selection. Click *Cancel* to exit the **Select columns** dialog without the column selection.

Enter Null Value

Click the *Value* button in the Criteria dialog to open the **Enter NULL Value** dialog.

Enter NULL Value Dialog

The **Enter NULL Value** dialog allows you to define a value to be used to define a NULL value.



*Define a NULL value criteria in the**Enter NULL Value**dialog.*

NULL Value

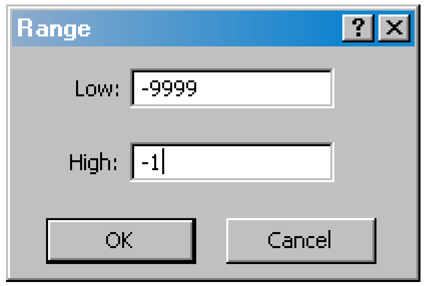
Type a value to define the NULL value. This value will be ignored in the data file.

After typing a value, click *OK* to return to the **Criteria** dialog. Click *Cancel* to return to the **Criteria** dialog without defining the NULL value.

Add Criteria Range - Clipping

Click the *Range* button in the Criteria dialog to open the **Range** dialog.

The **Range** dialog allows you to define a range of NULL criteria used.



*Define a range of NULL criteria values in the **Range** dialog.*

Low

Type a value to define the low end of the range. The *Low* value is included in the range.

High

Type a value to define the high end of the range. The *High* value is included in the range.

OK or Cancel

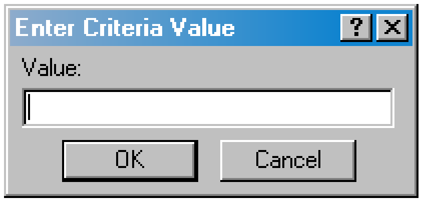
Click *OK* to return to the **Criteria** dialog and clip the data. Click *Cancel* to return to the **Criteria** dialog without clipping the data.

Enter Criteria Value

Click the *Add* button in the Criteria dialog to open the **Enter Criteria Value** dialog.

Enter Criteria Value Dialog

The **Enter Criteria Value** dialog allows you to define a criteria value. The criteria value is read from another column in the worksheet and contains the *Value* when the data point should be plotted on the graph.



Define a criteria value
in the ***Enter Criteria Value*** *dialog.*

Value

Type a value to define the criteria value. This value will be used to select which data points to be plotted on the graph. Data points that contain this *Value* in the specified column will be included in the plot.

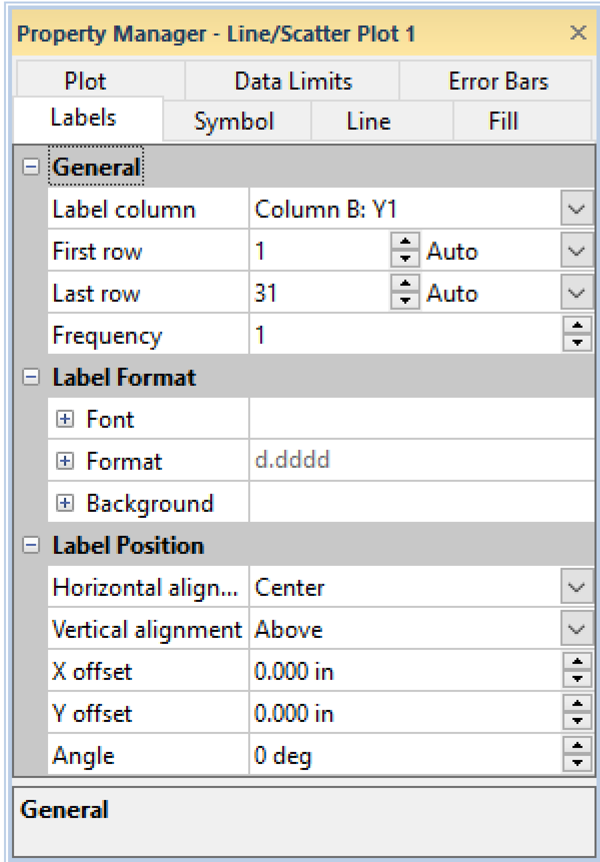
After typing a value, click *OK* to return to the **Criteria** dialog. Click *Cancel* to return to the **Criteria** dialog without defining the NULL value.

Plot Labels

Labels Properties

Data point labels can be shown on most plot types in **Grapher**. The labels can show data values or information from some other column in the data file. Labels can also be customized to appear in specific locations and can use a variety of formats, fonts, and colors to optimize the look and feel of the graph.

The following information is for all the options contained on the various **Labels** tabs. Not all options documented below apply to all labels for all plot types. To edit the labels, click on a plot to select it. In the [Property Manager](), click on the **Labels** tab.



*Set label properties in the **Property Manager** on the **Labels** tab.*

General

The *General* section includes the properties for specifying the column that contains the labels or the type of labels and how many labels should be displayed.

Label Column

Display labels on the plot by selecting the column that contains the labels. The column from which labels are added can be specified in the *Label column* list. Click *None* in the *Label column* field and select the desired column to display plot labels. The plot automatically updates to include the labels from the new column. Change the *Label column* to change which labels are displayed on the plot. Set the *Label column* to *None* to remove the labels from the plot.

When labels are plotted from a data column, you can include symbols in labels using Math Text commands in the worksheet.

Some plot types have more than one label column. For example, the vertical floating bar chart includes *Bottom label column* and *Top label column* properties. In this case, you can plot labels at the tops of the bars, bottoms of the bars, or both. The labels can be the same, or they can be from different columns.

Floating Bar Label Columns
For a floating bar chart, there are two labels columns: *Bottom label column* and *Top label column* for vertical floating bars or *Left label column* and *Right label column* for horizontal floating bars. You can display labels at either end of the floating bars or at both ends of the bars.

Stiff Plot Label Columns
For a stiff plot, there are *Left column* and *Right column* labels. The *Left column* displays labels on the left side of the stiff plot. The *Right column* displays labels on the right side of the stiff plot. To change the *Left column* or *Right column*, click on the existing column. In the list, select the new column. The plot automatically updates to include the labels from the new column.

Labels Type
Some plots use *Label type* properties to display plot labels rather than data columns. These plots include function plots and summation plots.

In function plots, you have the choice of displaying the X values or Y values as labels. Next to the *Label type* option, select *Y values* to display Y data values. Select *X values* from the *Label type* list to display Y values. Select *None* in the *Label type* list to remove the data labels.

In polar function plots, you have the choice of displaying the radius (R) values or angle (A) values. Next to the *Label type* option, select *Radius values* to display radius (R) data values. Select *Angle values* from the *Label type* list to display angle (A) values. Select *None* in the *Label type* list to remove the data labels.

In summation plots, you have the choice of displaying the X value or the cumulative Y value. Next to the *Label type* option, select *Y values* to display Y data values. Select *X values* from the *Label type* list to display Y values. Select *None* in the *Label type* list to remove the data labels.

Display Labels
Some plots use *Display labels* check boxes to display labels on the plot. The *Display labels* check boxes display data values or statistical information about the plot

For radar plots, select the *Display labels* check box to display the data values for the plot at each radar axis. Labels can be displayed or hidden for each radar plot individually.

For histograms, select *Display labels* to display the frequency for the bin as plot labels. The value is automatically updated to relative and/or cumulative frequency if the relative and/or cumulative frequency options are selected on the Plot page.

Worksheet Rows

You can choose the range of rows to plot labels in the *Worksheet rows* group. Click the ⊞ next to *Worksheet rows* to see the options. The default rows are the first and last rows containing data.

If *Auto* is selected for the *First row* and *Last row*, the first through last rows containing data are used as labels. To limit the range of the plotted labels, you can change the range of rows. Click on the word *Auto* and select *Custom*. Then highlight the existing value and type a new row number value. Alternatively, click the ⬍ next to the row value to increase or decrease the row. Press ENTER on the keyboard to make the change. To return to the default values, click the word *Custom* and select *Auto*. The *First row* or *Last row* will revert to the default rows.

Stiff Plot Label Rows

For a stiff plot, there are *Left rows* and *Right rows*. Click the ⊞ next to *Left rows* or *Right rows* to set the *First row, Last row*, and *Frequency*.

Frequency

Use the *Frequency* to control the number of labels in the plot. A *Frequency* of *1* displays a label for every data row. If the *Frequency* is set to 3, every third data point is labeled. To change the *Frequency* value, highlight the existing number and type a new number. Alternatively, click the ⬍ next to *Frequency* to increase or decrease the value. Press ENTER on the keyboard to make the change.

Label Format

The *Label Format* section includes the Font, Format, and Background properties for the plot labels.

Label Font

Click the ⊞ next to *Font* to set the label font properties. The font *Face, Size (points), Color, Opacity, Bold, Italic, Underline,* and *Strikethrough* properties can be set for most labels.

Label Format

Click the ⊞ next to *Format* to set the label format properties. The label *Type,* display of numbers, *Prefix,* and *Suffix* can be set for labels.

Label Background

Click the ⊞ next to *Background* to set the label background properties. The *Background* is the area behind the label. Click the ⊞ next to *Line* to set the line properties for the line that goes around the text. Click the ⊞ next to *Fill* to set the fill properties for the area around the text.

Label Position

The *Label Position* section includes properties for defining the label position and rotation.

Label Position

Bar chart and histogram labels can be set to draw at the top or the bottom of the bars by setting the *Label position* option. Set the *Label position* to *Top* or *Bottom*. To change the placement of the labels, click the existing option and select the desired option from the list.

Horizontal Alignment

The plot label can be positioned relative to the data point vertically, horizontally, and by specified amounts. *Horizontal alignment* controls the horizontal placement of the labels. You can position the labels to the *Left* or *Right* of the data point, *Center* the labels on the data point, or alternate the position of the labels to the left and right of neighboring data points (*Alternate left-right*). To change the horizontal placement of the labels, click the existing option and select the desired option from the list.

Vertical Alignment

Vertical alignment controls the vertical position of the data label. You can position the labels *Above* or *Below* the data point, *Center* the labels on the data point, or alternate the position of the labels above and below neighboring data points (*Alternate above-below*). To change the vertical placement of the labels, click the existing option and select the desired option from the list.

Z Alignment

The *Z alignment* is available for 3D XYY and 3D XYZ plots. Through the *Z alignment* setting, the plot labels may be drawn at the *Front*, *Center*, or *Back* of the 3D plot. To change the Z placement of the labels, click the existing option and select the desired option from the list.

Label Offset

Depending on the plot type, labels can be offset from their position along the X and Y directions or along the radial and angular directions. Offsets are specified in page units. To enter an offset, highlight the existing value and type a new value. Alternatively, click the to increase or decrease the value. Press ENTER on the keyboard to make the change.

X and Y Offset

Labels can be positioned at a custom position by entering values into the *X offset* or *Y offset* boxes. Entering a positive value into the offset box moves the label up for the *Y offset* or to the right for the *X offset*. Entering a negative value in the offset box moves the label down for the *Y offset* or to the left for the *X offset*.

Radius and Angle Offset

2D polar bar chart labels have a *Radius offset* and *Angle offset*instead of the*X offset*and*Y offset*.

The *Radius offset* moves the label closer or farther from the bar. Entering a positive value into the *Radius offset* box moves the label outward, away from the bar. Entering a negative value in the *Radius offset* box moves the label inward, into the bar. A value of zero positions the label at the end of the bar.

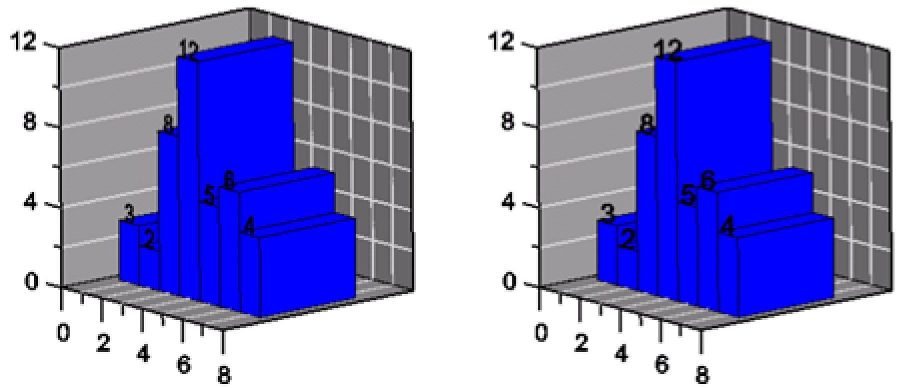
The *Angle offset* rotates the label around the angle axis. Entering a positive value into the *Angle offset* box moves the label in a clockwise direction from the bar. Entering a negative value in the *Angle offset* box moves the label in a counter-clockwise direction from the bar. A value of zero positions the label at the center of the bar. The *Angle offset* value is specified in degrees.

Angle

You can enter a number into the *Angle* box to rotate the data point labels. Positive values rotate the label in a counter-clockwise direction. The *Angle* is specified in degrees. To enter an angle, highlight the existing value and type a new value. Alternatively, click the to increase or decrease the value. Press ENTER on the keyboard to make the change.

Angled Labels

In 3D plots, check the box next to *Angled labels* to draw plot labels at the same angle as the plot. If this box is not checked the labels are always displayed parallel to the screen, no matter how the graph is tilted or rotated.



The graph on the left shows angled plot labels . Angled labels are parallel to the plot, not aligned with the screen. The graph on the right shows non-angled labels that are parallel to the screen.

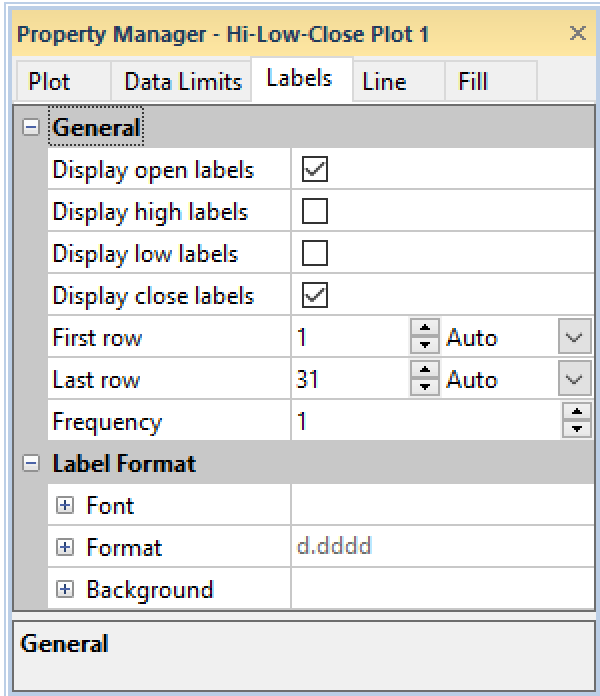
Label Leader Line

Label leader lines can be used to connect the text label to the data point. If the edge of the label is further than 0.1 inches (0.254 centimeters) away from the data point, label lines are displayed. This normally means that label lines are displayed if labels have been moved with the Move Labels command or if the *X offset* or *Y offset* values have been changed from zero. The line goes from the label to the point. Line properties can be changed for the label lines. To change the label line properties, change the properties in the *Label Leader Line Properties* section of the Line page.

Labels - High-Low-Close Plots

Data point labels can be shown on most plot types in **Grapher**. The labels can show data values or information from some other column in the data file. Labels can also be customized to appear in specific locations and can use a variety of formats, fonts, and colors to optimize the look and feel of the graph.

The following information is for the options contained on the **Labels** tab for hi-low-close plots. To edit the labels, click on a high-low-close plot to select it. In the Property Manager, click on the **Labels** tab.



*Set label properties in the **Property Manager** on the **Labels** tab.*

Display Labels

Check the *Display open labels*, *Display high labels*, *Display low labels*, or *Display close labels* boxes to display the open, high, low, or close label values. You can choose to display any combination of these labels.

Worksheet Rows

You can choose the range of rows to plot labels in the *Worksheet rows* group. Click the next to *Worksheet rows* to see the options. The default rows are the first and last rows containing data.

If *Auto* is selected for the *First row* and *Last row*, the first through last rows containing data are used as labels. To limit the range of the plotted labels, you can change the range of rows. Click on the word *Auto* to change it to *Custom*. Then highlight the existing value and type a new row number value. Press ENTER on the keyboard to make the change. Alternatively, click the next to the row value to increase or decrease the row. To return to the default values, click the word *Custom* and select *Auto* and*First row* or *Last row* will revert to the default rows.

Frequency

Use the *Frequency* to control the number of labels in the plot. A *Frequency* of *1* displays a label for every data row. If the *Frequency* is set to 3, every third data point is labeled. To change the *Frequency* value, highlight the existing number and type a new number. Alternatively, click the next to *Frequency* to increase or decrease the value. Press ENTER on the keyboard to make the change.

Label Format

The *Label Format* section includes the Font, Format, and Background properties for the plot labels.

Label Font

Click the next to *Font* to set the label font properties. The font *Face, Size (points), Color, Opacity, Bold, Italic, Underline,*and*Strikethrough*properties can be set for most labels.

Label Format

Click the next to *Format* to set the label format properties. The label *Type,* display of numbers, *Prefix,* and *Suffix* can be set for labels.

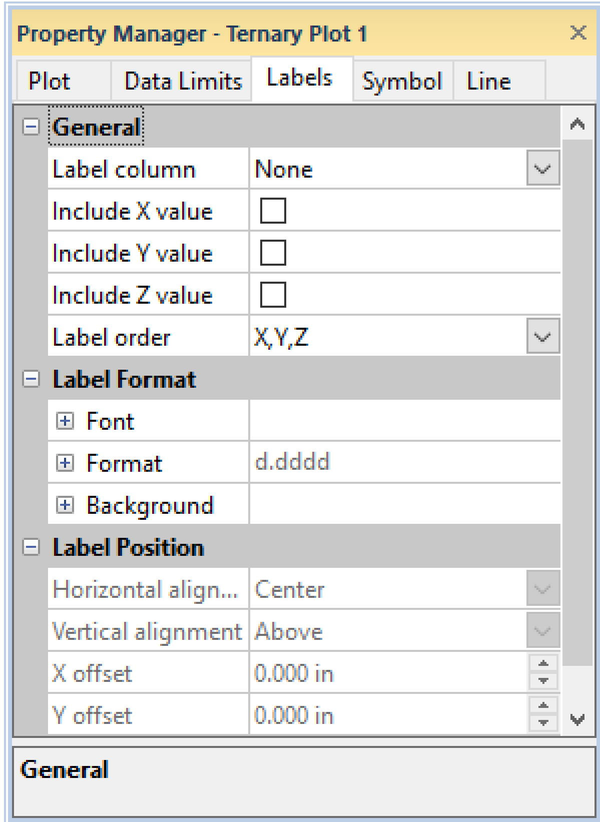
Label Background

Click the next to *Background* to set the label background properties. The *Background* is the area behind the label. Click the next to *Line* to set the line properties for the line that goes around the text. Click the next to *Fill* to set the fill properties for the area around the text.

Labels Page - Ternary and Piper Diagrams

Data point labels can be shown on most plot types in **Grapher**. For ternary and piper diagrams, the labels can show data values or information from some other column in the data file. Labels can also be customized to appear in specific locations and can use a variety of formats, fonts, and colors to optimize the look and feel of the graph.

The following information is for the options contained on the ternary diagram **Labels** tabs. To edit the labels, click on a ternary plot to select it. In the Property Manager, click on the **Labels**tab.



*Set label properties in the **Property Manager** on the **Labels** tab.*

Label Column

If the labels to be displayed on the plot are in another column, select the column in the *Label column* list. Click on the current column name next to *Label column* and select the new column to change the *Label column*. The plot automatically updates to include the labels from the new column. When worksheet labels are used, you cannot include X, Y, and Z values. If you wish to include X, Y, and/or Z values, set the *Label column* to *None*.

When labels are from a column in the data file, you can include symbols in labels using Math Text commands in the worksheet.

Worksheet Rows

You can choose the range of rows to plot labels in the *Worksheet rows* group. Click the ⊞ next to *Worksheet rows* to see the options. The default rows are the first and last rows containing data.

If *Auto* is selected for the *First row* and *Last row*, the first through last rows containing data are used as labels. To limit the range of the plotted labels, you can change the range of rows. Click on the word *Auto* and select *Custom*. Then highlight the existing value and type a new row number value. Press ENTER on the keyboard to make the change. Alternatively, click the next to the row value to increase or decrease the row. To return to the default values, click the word *Custom* and select *Auto* and *First row* or *Last row* will revert to the default rows.

Include X, Y, and Z Values

In ternary diagrams, you have the choice of displaying the X, Y, and Z values as part of the label by checking the boxes next to the *Include X value*, *Include Y value*, and *Include Z value* options. Check the box to display the label. The *Include X value*, *Include Y value*, and *Include Z value* options are not available when a column is specified in the *Label column* field. Set the *Label column* to *None* to use X, Y, and/or Z labels.

Label Order

In ternary diagrams, the label order list lets you specify the variable order in the labels. If a data point does not have a value for the variable it is not included in the label, the remaining values fill in the space; there is no gap where the missing variable would be located. To set the label order, click on the existing option. In the list, select the desired order. The plot will automatically update to show the new order. When X, Y, and Z values are included as labels, you cannot use worksheet labels.

Label Format

The *Label Format* section includes the Font, Format, and Background properties for the plot labels.

Label Font

Click the next to *Font* to set the label font properties. The font *Face, Size (points), Color, Opacity, Bold, Italic, Underline,*and*Strikethrough*properties can be set for most labels.

Label Format

Click the next to *Format* to set the label format properties. The label *Type,* display of numbers, *Prefix,* and *Suffix* can be set for labels.

Label Background

Click the next to *Background* to set the label background properties. The *Background* is the area behind the label. Click the next to *Line* to set the line properties for the line that goes around the text. Click the next to *Fill* to set the fill properties for the area around the text.

Label Position

The *Label Position* section includes properties for defining the label position and rotation.

Horizontal Alignment

The plot label can be positioned relative to the data point vertically, horizontally, and by specified amounts. *Horizontal alignment* controls the horizontal placement of the labels. You can position the labels to the *Left* or *Right* of the data point, *Center* the labels on the data point, or alternate the position of the labels to the left and right of neighboring data points (*Alternate left-right*). To change the horizontal placement of the labels, click the existing option and select the desired option from the list.

Vertical Alignment

Vertical alignment controls the vertical position of the data label. You can position the labels *Above* or *Below* the data point, *Center* the labels on the data point, or alternate the position of the labels above and below neighboring data points (*Alternate above-below*). To change the vertical placement of the labels, click the existing option and select the desired option from the list.

Label Offset

Labels can be positioned at a custom position by entering values into the *X offset* or *Y offset* boxes. Entering a positive value into the offset box moves the label up for the *Y offset* or to the right for the *X offset*. Entering a negative value in the offset box moves the label down for the *Y offset* or to the left for the *X offset*.

Angle

You can enter a number into the *Angle* box to rotate the data point labels. Positive values rotate the label in a counter-clockwise direction. The *Angle* is specified in degrees. To enter an angle, highlight the existing value and type a new value. Alternatively, click the  to increase or decrease the value. Press ENTER on the keyboard to make the change.

Label Leader Line

Label leader lines can be used to connect the text label to the data point. If the edge of the label is further than 0.1 inches (0.254 centimeters) away from the data point, label lines are displayed. This normally means that label lines are displayed if labels have been moved with the Move Labels command or if the *X offset* or *Y offset* values have been changed from zero. The line goes from the label to the point. Line properties can be changed for the label lines. To change the label line properties, change the properties in the *Label Leader Line Properties* section of the Line page.

Tips for Configuring Labels on Ternary Diagrams

A common way to portray labels on a ternary diagram is by having the labels surrounded by parentheses.

To format the labels with parentheses:

1. Select a ternary diagram plot.
2. In the **Property Manager**, click on the **Labels** tab. Check the *Include X value*, *Include Y value*, and *Include Z value* boxes.
3. Set the *Label order* to X, Y, Z.
4. Click the ⊞ next to *Format*.
5. Click the *Editor* button next to *Prefix.*
6. In the Text Editor, type a left parenthesis and click *OK*.
7. Click the *Editor* button next to *Suffix.*
8. In the **Text Editor**, type a right parenthesis and click *OK*.

For example, for data point X=55, Y=15, Z=30, the label appears as (0.55, 0.15, 0.30) when the axes are scaled 0 to 1. When the axes are scaled 0 to 100, the label appears as (55,15,30).

Tip for Label Scale

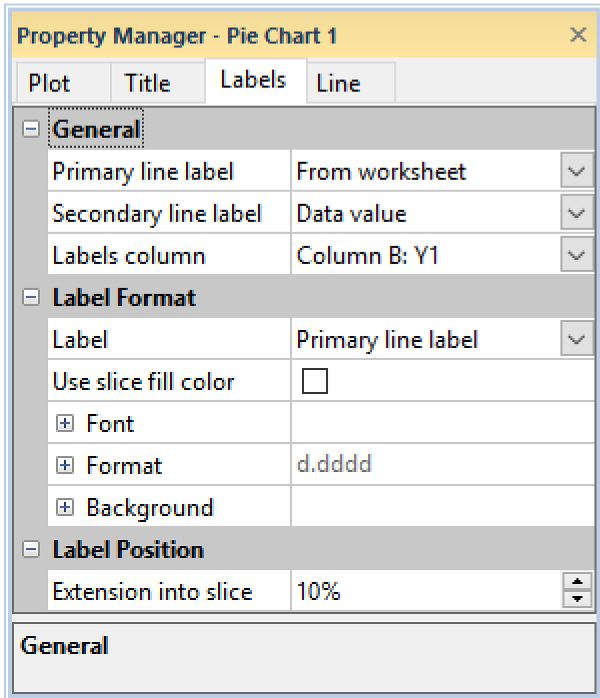
To display the values on a 0 to 100 scale instead of 0 to 1, click on one of the axes. In the **Property Manager**, click on the**Axis**tab. In the *Limits* section, check the box next to the *0 to 100 scale* option to display the label as (55, 15, 30).

Labels Page - Pie Charts and Doughnut Plots

Data point labels can be shown on most plot types in **Grapher**. For pie charts and doughnut plots, the labels can show the information in the labels column, data values, or the percentage the data value is of the whole pie. Labels can also be customized to appear in specific locations and can use a variety of formats, fonts, and colors to optimize the look and feel of the graph.

After being created, pie charts and doughnut plots are automatically labeled with two labels. The top label is the text in the worksheet's label column. The second label is the percentage of the pie for that slice. Either label can be altered to display data value, as well.

The following information is for the options contained on the pie chart and doughnut plots **Labels** tabs. To edit the labels, click on a pie chart or doughnut plot to select it. In the Property Manager, click on the **Labels** tab.



*Set label properties in the **Property Manager** on the **Labels** tab.*

Labels

Set the *Primary linelabel* and *Secondary line label* to *None*, *From worksheet*, *Data value*, or *Percentage*.

- The *None* option hides the label.
- The *From worksheet* option uses the *Labels column*.
- The *Data value*displays the value in the*Data column*.
- The*Percentage*calculates the percentage this slice is of the entire pie chart and displays the percentage value.

To change the *First line label* or *Second line label,* click on the current option. Select the desired option from the list.

Label Format

The *Label Format* section includes the font, format, and background options for the labels.

Label

Select the label you wish to edit in the *Label* field. Select *Primary line label* to edit the font, format, and background properties for the first label. Select *Secondary line label* to edit the font, format, and background properties for the second label.

Use Slice Fill Color

Check the box next to the *Use slice fill color* command to color the labels with the same color as the foreground color of the slice.

Label Font

Click the ⊞ next to *Font* to set the label font properties. The font *Face, Size (points), Color, Opacity, Bold, Italic, Underline,*and*Strikethrough*properties can be set for most labels.

Label Format

Click the ⊞ next to *Format* to set the label format properties. The label *Type,* display of numbers, *Prefix,* and *Suffix* can be set for labels.

Label Background

Click the ⊞ next to *Background* to set the label background properties. The *Background* is the area behind the label. Click the ⊞ next to *Line* to set the line properties for the line that goes around the text. Click the ⊞ next to *Fill* to set the fill properties for the area around the text.

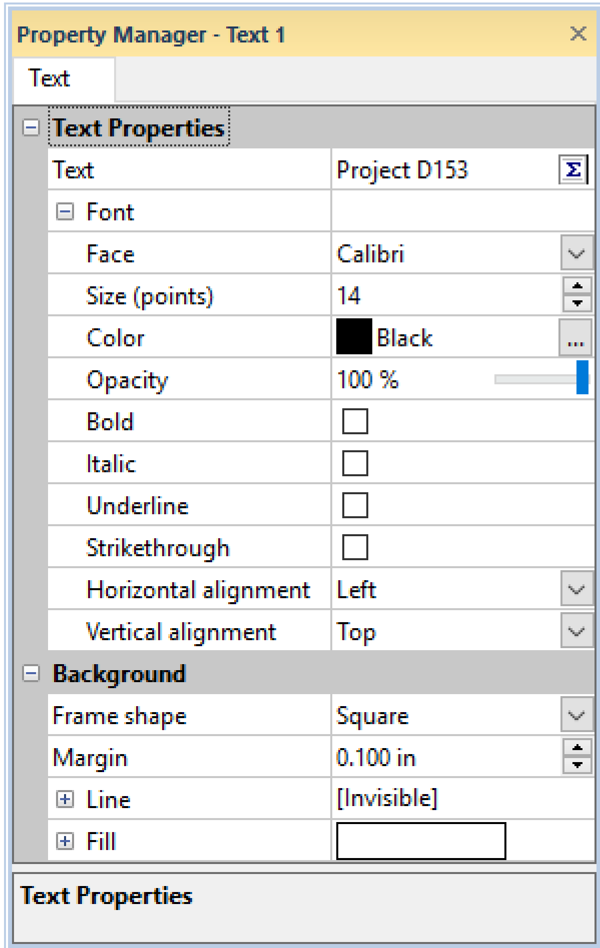
Label Line

Label lines can be used to connect the text label to the slice. Line properties can be changed for the label leader lines on the Line page.

The *Extension into slice* option determines the distance the label line extends into the slice. For example, a distance of 50 percent extends the line halfway into the slice, toward the center of the chart. To change the *Extension into slice* value, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the ⬍ to increase or decrease the extension into the slice.

Text Properties

Text properties can be changed for most text objects. To set properties for most text objects, open the *Font*section in the Property Manager to set the text or label properties.



*The text properties appear in the **Property Manager** in a* Text Properties *section or* Font *section.*

Text

Quickly set the text by typing directly in the *Text* field. Math text instructions can be used in the title *Text* field. Click in the *Text* field to add complex formatting or text in the Text Editor dialog.

Math text instructions are used to apply unique formatting to characters or words in the text and to create multi-line text. When a change is made to the entire *Text* string in the **Text Editor**, the following *Font* properties are updated. Conversely, changing any of the *Font* properties affects the entire *Text* string. However, math text instructions take precedence over *Font* properties. When a change is made to a subset of the text, the **Text Editor** adds the appropriate math text instructions to the *Text* field.

Face

The *Face* is the font that is used for the text. To change the *Face*, click on the current font name. Select the desired font name from the list. Click the arrow button or select a font and use the ARROW keys on the keyboard to scroll through the *Face* list. The selected font is displayed in the **Text Editor**. The font files that are installed on your computer are displayed in the Font list. **Grapher** supports true type fonts.

Size (Points)

Set the text size in the *Size (points)* field. Highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the size. A *Size (points)* value between zero and 720 can be specified.

Color

Change the *Color* of the text by clicking on the color box. Select a new color by clicking on a color in the color palette. Create new colors by clicking the ... button to the right of the color name.

Opacity

The *Opacity* controls the transparency of the text. Select a value between 0% (zero opacity, full transparency) to 100% (full opacity, zero transparency). To set the opacity, highlight the existing value and type a new number. Press ENTER on the keyboard to make the change. Alterantively, click and drag the to change the opacity percentage.

Style

In most instances, there are check boxes for the style options. Check the box next to*Bold, Italic, Underline,*and*Strikethrough*to apply one or more of these styles to the text or label. Note that some typefaces, such as *Symbol*, do not support bold or italicized text.

- *Bold* will increase the thickness of the text (i.e. **example**).
- *Italic* will create oblique text (i.e. *example*).
- *Underline* will add a horizontal line under the text (i.e. example).
- *Strikethrough* will add a horizontal line through the center of the text (i.e. ~~example~~).

Alignment

The *Alignment* controls the location of the text relative to the reference point. A reference point is the point clicked in the plot window when the crosshair cursor is placing the text on the screen. The text box is horizontally and vertically aligned relative to the reference point. The default position is that the reference point is at the upper left corner of the bounding box (left, top).

- *Left* horizontally aligns the text box so that the reference point is to the left of the text box.
- *Center* horizontally centers the text box on the reference point.
- *Right* horizontally aligns the text box so that the reference point is to the right of the text box.
- *Top* vertically aligns the text box so that the reference point is above the text box.
- *Baseline* vertically aligns the text box so that the reference point is located at the base of the text. The baseline is the imaginary line along which characters are positioned as they are drawn. Descenders on characters, e.g., "tails" in the letters p and q, are drawn below the baseline.
- *Bottom* vertically aligns the text box so that the reference point is below the text box.
- *Center* vertically centers the text box on the reference point.

Text Box Properties

The text object includes background and margin settings in the **Text** properties.

Frame

The *Frame shape* property changes the background shape of the text box from square corners to rounded corners. Select a *Square* or *Rounded* frame shape.

Margin

The *Margin* property sets the padding between the text and the text box frame. Values range between 0 and 1 inches (0 and 2.54 cm) for the *Margin*. To enter a *Margin*, highlight the existing value and type a new value or press the to increase or decrease the value. Press ENTER on the keyboard to make the change.

Background Line and Fill

Set the background line properties in the *Line* section. Set the background fill properties in the *Fill* section.

Default Settings

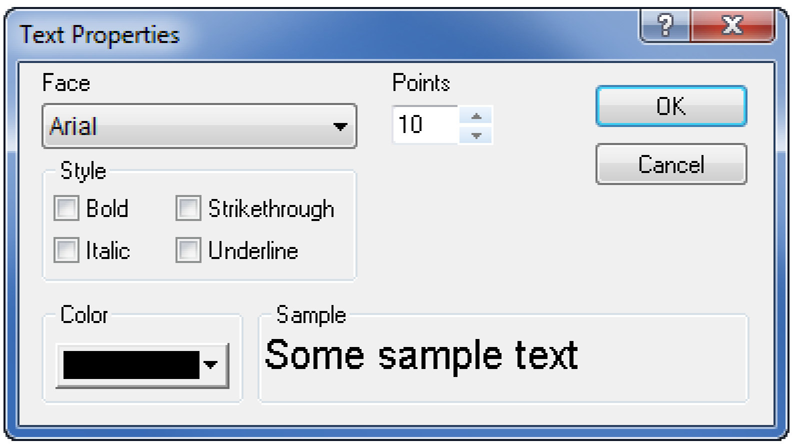
You can set default text properties with the File | Options command. In the **Options** dialog, scroll down to the *Defaults* section and click on the word *Font* to access these defaults. Changes made in the **Options** dialog affect all subsequent documents.

ANSI Translated Using

ANSI encoding contains characters within the first 256 characters of a font. These are normally in English. Select the code page from the list that will read the data correctly. The selected code page is the default language to use with Unicode text. This text option is only available in the **Options** dialog Defaults page.

Font Properties Dialog

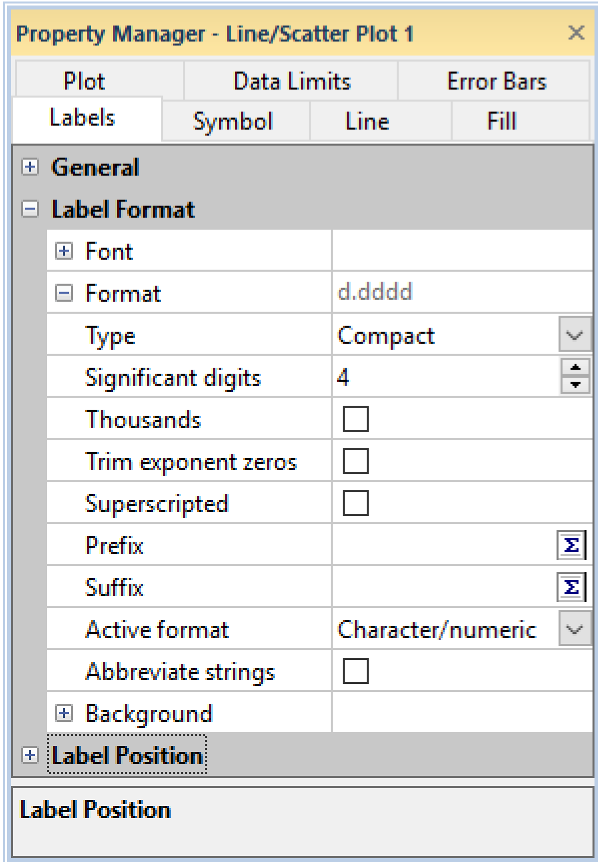
When changing some options, a **Text Properties** dialog is displayed. The options are the same as described above in the **Property Manager**. In addition, the **Text Properties** dialog has a *Sample* section where the font can be previewed.



*Set the text properties in the **Text Properties** dialog.*

Label Format

Labels contain text and other formatting such as the number of decimal places. You can change the label format in the *Format* section on the **Labels** tab in the **Property Manager**.



*Use the **Label Format** options to change the label format.*

Font

The *Font* section includes the font properties for the labels.

Sample

The sample shown next to the *Format* line shows the selected numeric format.

Type

There are five number format types available in the *Type:Compact, Fixed,Exponential, General*, and *Date/Time.*

The*Compact* option displays numbers as fixed or exponential depending on the number set in the *Significant digits* box. For example, if the numeric format is set to *General* with two significant digits, 1447 shows as 1.4E+03. If the *Significant digits* are set to six, 1447 is displayed as 1447.

The *Fixed* option displays numbers as dd.dd. Change theDecimal placesto show more or less fixed locations after the decimal character.

The *Exponential* option displays numbers as d.ddE+dd where

The *General* option displays the labels in fixed or exponential fashion, whichever requires fewer digits.

The *Date/Time* option displays the labels in a date time format. To use date/time formatted plot labels, the plot's data column must be formatted as date/time in the worksheet.

Significant Digits

The *Significant digits* display the total number of digits to use for the entire number. This option is only available when the *Type* is set to *Compact*.

Decimal Places

The numbers to the right of the decimal are set in the *Decimal places* box. For example, if the numeric format is set to *Fixed* with three decimal places, the number 2009 displays as 2009.000. This option is available when the *Type*is set to*Fixed*or*Exponential*.

Thousands

Check the *Thousands* box to show the *Thousands separator*to the left of every third digit left of the decimal symbol. The *Thousands* property is disabled when the *Type* is set to *Exponential*.

Thousands Separator

If the *Thousands* box is checked, a symbol will appear to the left of every third digit left of the decimal point. To set the symbol, click the existing option displayed next to *Thousands separator*. In the list, select *Auto, Period, Comma, Space,* or *Custom* to specify what will appear as the thousands separator. For example, if *Comma* is selected, then 8000 displays as 8,000. If *Period* is selected, then 8000 displays as 8.000. If *Space* is selected, then 8000 displays as 8 000. The button will be updated to reflect the selected separator symbol. The *Thousands Separator* property is disabled when the *Type* is set to *Exponential*.

Custom Separator

If *Thousands separator* is set to *Custom*, click in the box next to *Custom separator.* Enter a custom separator value into the box and press ENTER on the keyboard to make the change. The *Custom Separator* property is disabled when the *Type* is set to *Exponential*.

Trim Exponent Zeros

When *Compact* or *Exponential* is selected for the *Type,* the *Trim exponent zeros* option is available. When this box is checked, exponential numbers are written as 1.99E+2. When this box is not checked, exponential numbers are written as 1.99E+02.

Superscripted

When *Compact* or *Exponential* is selected for the *Type,* the *Superscripted* option is available. When this box is checked, exponential numbers are written as $1.99x10^2$. When this box is not checked, exponential numbers are written as 1.99E+02.

No 1x's

When the *Type* is set to *Compact* or *Exponential* and *Superscripted* is checked, you can remove the "1x" before the numbers by checking the box next to the *No 1x's* option. For example $1x10^2$ will be displayed as 10^2 when *No 1x's* is checked. This option will also make the value zero appear as 0.

Active Formats

- Select *Character/numeric* to display both text and numbers in the labels.
- Select *Character only* to show only text labels.
- Select *Numeric only* to show only numeric labels.

Abbreviate Strings

Check the *Abbreviate strings* box to limit the number of characters that appear in the label.

Max Characters

When the *Abbreviate strings* option is checked, the *Max characters* option is available. Set the number of characters that should appear in the labels in the *Max characters* box. Use the  buttons or enter a value directly into the box. Press ENTER on the keyboard to make the change.

Prefix

The *Prefix* property adds text in front of the labels. Type text or math text instructions in to the *Prefix* field or click the Σ button to open the Text Editor to add a label prefix. The *Prefix* font properties are controlled by the **Text Editor** or math text instructions and are not linked to the label font.

Suffix

The *Suffix* property adds text after the labels. Type text or math text instructions in to the *Suffix* field or click the Σ button to open the Text Editor to add a label suffix. The *Suffix* font properties are controlled by the **Text Editor** or math text instructions and are not linked to the label font.

Date/Time Format

If you are using date/time formatting, click the *Select* button next to *Date/time format* to open the Date/Time Format Builder dialog. Custom date and time formats can be added, edited, or deleted in the **Date/Time Format Builder** dialog. Select the appropriate format and click *OK* to make the change and return to the *Format* section. Click *Cancel* to return to the *Format* section without making any change.

Background

The *Background* section includes the line properties and fill properties for the label background.

Move Labels

The **Graph Tools | Plot Tools | Move Labels** command is used to move individual plot labels, axis tick mark labels, axis titles, graph titles, legend entries, and legend titles. This is useful when the labels or titles overlap each other. End **Move Labels** mode by pressing the ESC key, clicking **Graph Tools | Plot Tools | Move Labels** again, or by clicking the Select Tool.

The plot window cannot be panned with the middle mouse button when **Move Labels** mode is active. If you need to change the view, use the vertical and horizontal scroll bars to change the view. You can also zoom in and out in **Move Labels** mode by rolling the mouse wheel.

The plot window auto-scrolls when a label is dragged into the edge of the plot window. The plot window auto-scrolls in increments while in **Move Labels** mode. If you need to move a label outside of the current view, slowly drag the label to the edge of the plot window. Drag the label back into the plot window, and then drag the label to the edge of the plot window again. Repeat this process until the location where you want the label is visible in the plot window. Finally, drag the label to the desired position.

Return labels, titles, or entries to their default locations by selecting an object and clicking the Reset Positions command.

To Move Plot Labels:

1. Select a single plot.
2. If labels are not already displayed on the plot, check the *Display labels* box on the Labels tab in the Property Manager.
3. Click the **Graph Tools | Plot Tools | Move Labels** command or right-click and select **Move Labels**.
4. Click on a label and drag it to a new location.
5. When you have finished positioning labels press the ESC key.

To Move Graph Titles:

1. Select a graph.
2. If a graph title is not already displayed, click on the Title tab in the Property Manager.
3. Click the *Editor* button next to the *Title* command.
4. In the dialog, type the graph title and click *OK*.
5. Click the **Graph Tools | Plot Tools | Move Labels** command or right-click and select **Move Title**.
6. Click on the graph title and drag it to a new location.
7. When you have finished positioning the graph title, press the ESC key to make the change.

To Move Axis Titles or Axis Labels:

1. Select a single axis.
2. If tick labels are not already displayed on the axis, check the *Show labels* boxes on the Tick Labels tab in the Property Manager.
3. If axis titles are not already displayed on the axis, click the *Editor* button next to the *Title* command on the Axis tab in the **Property Manager**.
4. In the dialog, type the axis title and click OK.
5. Click the **Graph Tools | Plot Tools | Move Labels** command or right-click and select **Move Labels**.
6. Click on a tick label or axis title and drag it to a new location.
7. When you have finished positioning tick labels or the axis title, press the ESC key to make the change.

To Move Legend Titles or Entries:

1. Select a single legend.
2. Click the **Graph Tools | Plot Tools | Move Labels** command or right-click and select **Move Labels**.
3. Click on the legend title or entry and drag it to a new location.
4. When you have finished positioning the legend title and entries, press the ESC key to make the change.

Reset Positions

Click the **Graph Tools | Plot Tools | Reset Positions** command to return any labels, titles, or legend entries that have been moved with the Move Labels command to their default positions. Only the labels for the selected object are returned to their default positions when the **Reset Positions** command is clicked.

- Select a plot and click **Graph Tools | Plot Tools | Reset Positions** to reset the positions of plot labels.
- Select an axis and click **Graph Tools | Plot Tools | Reset Positions** to reset the positions of the tick labels and axis title.
- Select a graph and click **Graph Tools | Plot Tools | Reset Positions** to reset the position of the graph title.
- Select a legend and click **Graph Tools | Plot Tools | Reset Positions** to reset the positions of the legend title and legend entries.

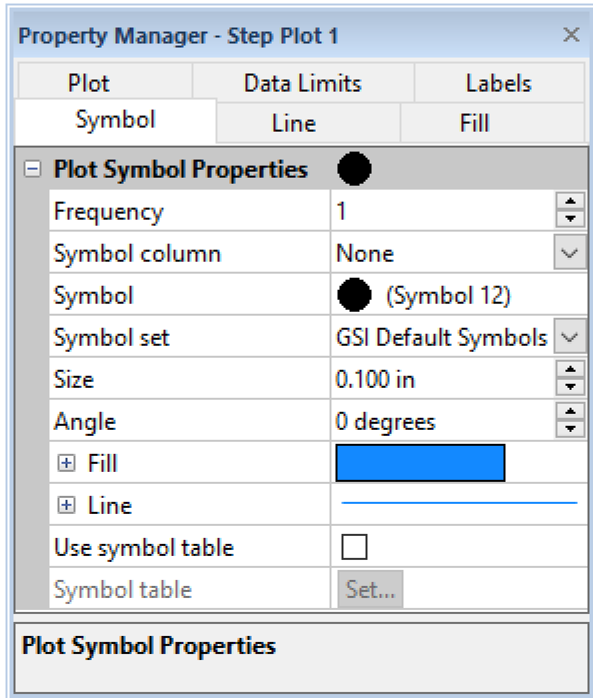
Symbol Properties

Symbol Properties

Symbol properties can be changed for selected objects in the plot window. You can set default symbol properties through the File | Options command. In the **Options** dialog, click on *Symbol* in the *Defaults* section to access these defaults. Changes made in the **Options** dialog affect all subsequent documents. Custom symbols can be created using a third party TrueType font editing software.

To change the symbol properties on a plot, click on the plot in the Object Manager or the plot window to select it. The plot properties are displayed in the Property Manager.

The **Symbol** page in the **Property Manager** contains the properties for all symbols in the plot. For example, a line/scatter plot **Symbol** page will include a *Plot Symbol Properties* section. If average value error bar symbols are displayed, then the **Symbol** page will also include an *Average Value Symbol Properties* section.



The symbol properties are set in the ***Property Manager*** *on the* ***Symbol*** *tab.*

Symbol Frequency

The *Frequency* option allows you to specify how often a symbol appears on the plot. For example, set the *Frequency* value to 2 to display a symbol at every other data point on a graph. Change the *Frequency* value to 3 to display a symbol at every third data point on the graph. To change the *Frequency*, highlight the existing value and type a new number. Press ENTER on the keyboard to make the change. Alternatively, click on the  to increase or decrease the value. The *Frequency* can be any number between 0 and 2147483647. The plot automatically updates to show the new frequency.

Symbol Column

The *Symbol column* option allows you to select symbols from a specific column in the worksheet. To select a *Symbol column*, click on the current column name or the word *None* and select the desired column from the list. When the *Symbol column* is set to *None*, all symbols in the plot are controlled by the **Symbol** properties page.

The values in the worksheet symbol column can have three forms:

- *Symbol set:Index* displays a symbol from a specific symbol set. The *Symbol set* is the font from which the symbol is selected. The *Index* is the symbol's index number in the font. For example, the cell value *Arial:87* in the worksheet would make the symbol a lowercase "w" in the Arial font in the plot.
- *Index* displays a specific symbol from the symbol set specified in the *Symbol set* field in the **Symbol** page. The default symbol set is *GSI Default Symbols*. For example, a cell value of *12* in the worksheet would set the symbol to a filled circle if the *Symbol set* is set to *GSI Default Symbols* in the **Property Manager**.
- An empty cell displays the symbol specified by the *Symbol* and *Symbol set* properties in the **Symbol** page.

The symbol index value is the symbol number as it appears in the **Symbol** properties *Symbol* field. This is the 0-based offset of the symbol within the symbol set. To use the symbol index in a data column, use the value displayed in the **Symbol** properties. The symbol index value is the ASCII code minus 32. For example, the ASCII code for the Arial font uppercase A is 65. The index value displayed in the symbol properties and used in the symbol column is 33.

You can use the Windows character map utility to determine the ASCII code for font symbols, and you can then subtract 32 from the ASCII code to determine the index value. However, it is generally faster to obtain the index value directly from the **Symbol** page *Symbol* property. Note that the character map utility displays ASCII codes in hexadecimal. For example U+0041 is displayed in the Windows Character Map for uppercase A. Convert the hexadecimal value 0x41 to a decimal value: 4 x 16 + 1 = 65. This value, 65, is the ASCII code in decimal notation. The Index value is 33 (65 - 32 = 33).

Symbol

The *Symbol* is the symbol that is displayed on the plot when the *Symbol frequency* value is greater than 0. To change the *Symbol*, click on the existing symbol. The symbol palette is displayed. Click on the new symbol. The plot is automatically updated to show the new symbol.

The symbol number is indicated in the title bar above the symbol palette and adjacent to the *Symbol* in the Property Manager. The symbol number is the 0-based offset of the symbol within the symbol set. The symbol number is used in a column when the*Symbol column*option is enabled.

Symbol Set

The *Symbol set* displays the font that is currently used for the symbol. To change the *Symbol set*, click on the existing symbol set name. In the list, select a new font from the list. All TrueType fonts are listed in the *Symbol set*.

Size

The *Size* controls the symbol size. This is the size of the full symbol box, not just the symbol. To change the *Size* of the symbol, highlight the existing value and type a new number in the box. Alternatively, click on the to increase or decrease the size of the symbol. Symbol sizes are between 0.0 and 4.0 inches (0.0 and 10.16 centimeters) and are shown in page units.

Note that the symbol *Size* is affected by the line *Width* setting. When you change the *Size* value only the symbol size changes. However if you deselect the symbol and select the object again, the *Size* value updates automatically to display the symbol *Size* value plus the line *Width* value, i.e. the overall size of the symbol. Consider the two following examples: You desire a symbol *Size* of 0.200 inches with a line *Width* of 0.005 inches. If you enter these values into the respective property fields, the overall symbol size will be 0.205 inches. Now you desire a symbol with a line width of 0.005 inches and overall symbol size of 0.200 inches. Then you must enter 0.195 in the *Size* field and 0.005 in the *Width* field. The overall symbol size will be 0.200 inches.

Symbol Angle

The *Angle* property controls the symbol rotation. Enter a value between -360 and 360 to rotate the symbol. Positive values rotate the symbol counterclockwise, and negative values rotate the symbol clockwise. The *Angle* is specified in degrees. To change the *Angle*, highlight the existing value and type a new number. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the rotation value.

Fill Properties

The *Fill* controls the inside color, opacity, and pattern of the symbol, when the selected symbol is a filled symbol. To change the *Fill* properties of the symbol, click the next to *Fill* to open the *Fill* section. Set the *Pattern, Foreground color, Foreground opacity, Background color, Background opacity, Stretch,* and *Scale* for the inside portion of the filled symbol. Refer to the Fill Properties page for information about the various fill options.

Note that 3D plots do not support symbol fill properties. A *Color* and *Opacity* option are available to control the symbol color and opacity for 3D symbols.

Fill Color Column

Symbols can be assigned fill colors from a data color column. Select the color column in the *Color variable* list to apply symbol fill colors from the worksheet. The fill style is automatically set to *Solid* when a *Color variable* is used.

When the selected color variable includes numeric data, the data are mapped to a color gradient and the color mapping is applied to the symbols. Select a predefined color gradient in the *Colormap* list or click the button to set the color gradient in the Color Gradient dialog.

When the selected color variable includes text data, the colors are specified by name or RGB value.

Colors can be specified in the worksheet by many different methods.

Method	**Example**
<color>	Red
<color>:<a>	Red:255
RGB(<r>,<g>,<b>)	RGB(255,0,0)
\COLOR(<r>,<g>,<b>,<a>)	\COLOR(255,0,0,255)
R<r> G<g> B<b>	R255 G0 B0
R<r> G<g> B<b> A<a>	R255 G0 B0 A255
\RGBR<r> \RGBG<g> \RGBB<b>	\RGBR255 \RGBG0 \RGBB0

where <r>, <g>, <b>, and <a> are red, green, blue, and alpha values between 0 - 255 and <color> is a color name as it appears in the color palette.

Show Color Scale

The *Show color scale* property is displayed when a *Color variable* is used for the symbol fill colors. Select the *Show color scale* property to display a color scale bar in the plot window. Clear the *Show color scale* property or delete the color scale to remove it from the plot window.

Line Properties

The *Line* controls the outside edge of the symbol. To change the symbol *Line* properties, click the next to *Line* to open the *Line* section. Set the

Style, *Color*, *Opacity*, and *Width* for the edge of the symbol. Note that 3D plots do not support symbol outline colors. Refer to the Line Properties page for information about the various options.

Use Symbol Table

Check the box next to *Use symbol table* to determine the symbol based on a symbol table. The *Symbol table* option becomes active. Uncheck the box next to *Use symbol table* to turn off the symbol table functionality. The symbol table option allows symbols to change from one point to the next based on a table of symbols. A symbol table can also allow different symbols for each point or allow for repeating symbols.

Show Symbol Table Legend

Select the *Show symbol table legend* property to display a symbol table legend.

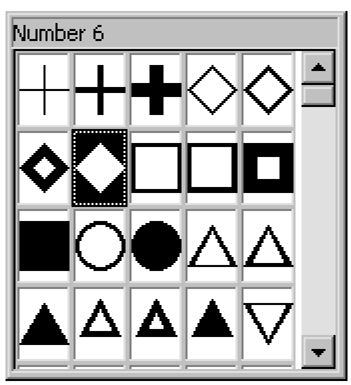
Symbol Table

Click the *Set* button next to the *Symbol table* option to open the Symbol Table dialog and control which symbols are used in the plot.

Symbol Palette

Click the symbol button to open the symbol palette.

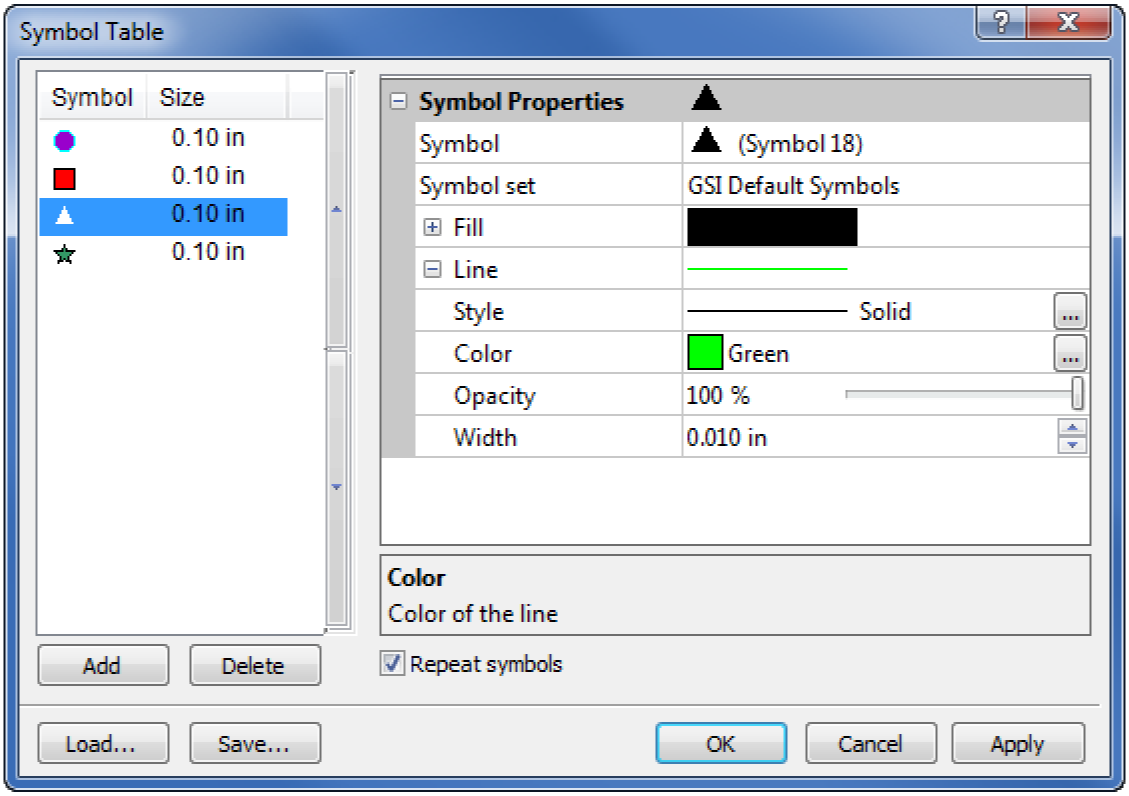
- The number of the symbol appears at the top of the palette.
- Click on a symbol to select it.



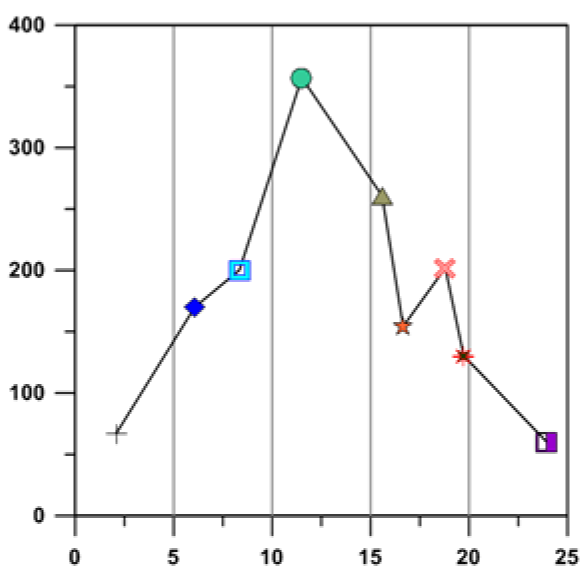
Use the symbol palette to select a symbol.

Symbol Table

Use the **Symbol Table** dialog to control which symbols are used in the plot. The *Symbol table* option is enabled on the **Symbol** tab of the [Property Manager]() when the *Use symbol table* box is checked.



*Use the**Symbol Table**dialog to control which symbols are used.*



This Line/Scatter plot is using symbols from
a non-repeating ***Symbol Table***.

Symbol and Size

The names and sizes of all available symbols appear in the *Symbol* and *Size* columns. Click the *Symbol* or *Size* buttons to open the Symbol Color dialog and change the symbol color fill, line, and size properties of all symbols in the symbol table. The default color is black and the default size is 0.20 inches (0.51 centimeters).

Symbol Properties

Use the *Symbol Properties* section to change properties of the symbol selected in the symbol table. Each symbol can have a separate *Symbol, Symbol set, Size, Fill* properties, and *Line* properties.

Note that 3D plots do not support symbol fill properties. A *Color* and *Opacity* option are available to control the symbol color and opacity for 3D symbols.

Assigning Symbols to the Symbol Table

The **Symbol Table** dialog allows you to specify the symbols in the table. Click the *Add* button to add a new symbol to the table. You can modify the selected symbol in the *Symbol Properties* section of the **Symbol Table** dialog. Use the arrow buttons on the side of the symbol list to change the order of the symbols. Click *Delete* to remove the selected symbol from the list.

Repeat Symbols Option

Check the box next to the *Repeat symbols* option to repeat symbols throughout the chart when the end of the symbol list is reached. For example, if a line/scatter plot has 20 data points and the symbol table in use has only 10 symbols, the second set of 10 data points in the line/scatter plot uses the same symbols as the first 10 data points. If the*Repeat symbols*option is left unchecked, the default symbol of the plot is used for the remaining symbols once the end of the symbol table is reached.

Loading a Symbol Table

Click the *Load* button in the **Symbol Table** dialog to load an existing symbol table .GST file. The **Open** dialog is displayed. Click the .GST file you want to use, click the *Open*button, and the symbol table is updated to show the symbol table file settings.

Saving a Symbol Table

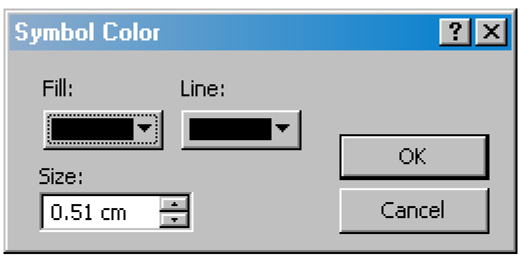
Click the *Save* button in the **Symbol Table** dialog to create a symbol table .GST file based on the current symbol table settings. When you click the *Save* button, the **Save As** dialog is displayed. Type the file name for the symbol file and click the *Save* button. The file is saved for use with other plots.

OK, Apply, Cancel

After you have made all of your changes, click the *Apply* button to apply the changes without exiting the **Symbol Table** dialog. The plot updates to show the changes, while the dialog is still displayed. Click the *OK* button to save your changes and close the **Symbol Table** dialog. Click the *Cancel* button to exit the **Symbol Table** dialog without saving your changes.

Symbol Color

Access the **Symbol Color** dialog by clicking on the *Symbol* or *Size* header buttons on the left side of the Symbol Table dialog. The **Symbol Color** dialog is used to change the color and size of fills and lines for all symbols in the symbol table. Use the *Symbol Properties* section of the **Symbol Table** dialog to change individual symbol properties.



Change the Fill, Line*, or* Size *of the symbol in the***Symbol Color***dialog.*

Fill

Click the *Fill* button to open the color palette. Select a color to use for the symbol fill.

Line

Click the *Line* button to open the color palette. Select a color to use for the symbol line.

Size

Highlight the existing value and type a new value in the *Size* box. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the symbol size. Symbol sizes are between 0.0 and 4.0 inches (0.0 and 10.16 centimeters) and are shown in page units.

OK or Cancel

Click the *OK* button to close the dialog and save your changes. Click the *Cancel* button to close the dialog without saving your changes.

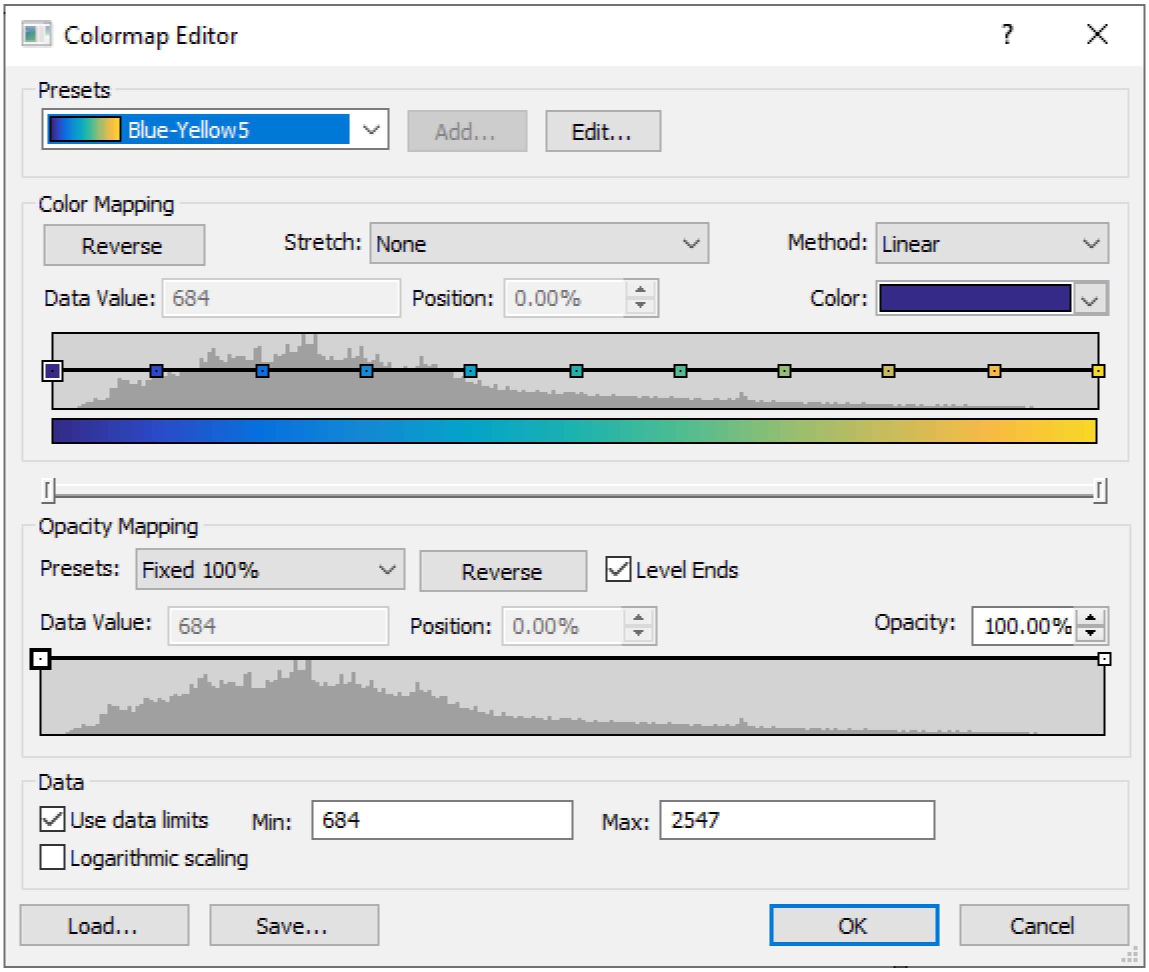
Symbol Table File Format

Symbol table .GST files are used to define a symbol table, the symbols used by a line/scatter plot. The file format is proprietary and is not readable by the user. Symbol table files are not directly editable; rather, they must be edited via the **Symbol Table** dialog in **Grapher**.

Color Gradient

Colormap Editor

The **Colormap Editor** is used to assign a gradation of colors to contour levels fill, XYZ bubble plot bubble fill, and any gradient fills. The color spectrum has specific colors assigned to anchor nodes along the spectrum. **Grapher** automatically blends colors to produce a smooth color gradation over the color fill. After you create a color spectrum, you can save custom spectrums for later use with other plots, plot fills, or object fills. Several predefined color spectrum .CLR files are available in C:\Program Files\Golden Software\Grapher\Color Scales\ by default.



*Use the **Colormap Editor** to assign gradient colors to a fill.*

Presets

The *Presets* section includes the list of presets and commands for modifying the preset color gradient list. Select a predefined .CLR file from the *Presets* list. When a custom colormap is displayed in the **Colormap Editor**, click *Add* to add the custom colormap to the *Presets* list. Click *Edit* to edit the *Presets* list in the Edit Presets List dialog.

Color Mapping

The *Color Mapping* section includes options for mapping specific colors to data values, distributing color anchor nodes, and interpolation methods.

Reverse

The *Reverse* button flips the order of colors in the colormap so that colors currently associated with low data values will be mapped to high values and colors currently associated with high values will be mapped to low values. The sample colormap updates to show the new color order.

Stretch

The *Stretch* field includes options to distribute colors (anchor nodes) across the colormap based on data values.

- By default, the *Stretch* is set to *None*. When *None* is selected, each anchor node can be positioned independently.
- Select *Evenly Distribute* to evenly distribute the anchor nodes between the data minimum and maximum. The nodes are automatically redistributed evenly when nodes are added or removed or when the data *Min* or *Max* is changed.
- Select *Equalize* to distribute the nodes to improve the contrast in the map via histogram equalization. The nodes are distributed so that each histogram "bin" between nodes contain an equal number of data points. The nodes are automatically redistributed evenly when nodes are added or removed. The *Equalize* option is not available when a histogram is not displayed, i.e. for watershed maps.

The *Stretch* option must be set to *None* before anchor nodes can be manually positioned.

Interpolation Method

The *Method* option determines which interpolation method is used to specify the colors between anchor nodes.

- *Linear* interpolation uses weighted averages to interpolate colors between nodes. This linear interpolation between each color node results in a nice gradational transition and smooth appearance.
- *Reverse* interpolation uses weighted averages to interpolate colors between nodes like the *Linear* interpolation. However, the colors are reversed between nodes. This reverse linear interpolation between each color node results in a segmented appearance.
- *Cosine* interpolation uses 180 degree segments of the cosine wave. The rate of change of the color is faster than the *Linear* interpolation. This interpolation results in a smooth appearance.
- *Flat Start* applies the color from the left node to the area between nodes. This interpolation results in a sharp transition between colors.
- *Flat Middle* applies the color from the midpoint linear interpolation between the left and right nodes to the area between nodes. This interpolation results in a sharp transition between colors.
- *Flat End* applies the color from the right node to the area between nodes. This interpolation results in a sharp transition between colors.

- *HSL CW* interpolates the colors between nodes from the Hue-Saturation-Luminosity color wheel in a clockwise direction.
- *HSL CCW* interpolates the colors between nodes from the Hue-Saturation-Luminosity color wheel in a counterclockwise direction.
- *HSL Shortest* interpolates the colors between nodes from the shortest distance (clockwise or counterclockwise)on the Hue-Saturation-Luminosity color wheel between each node pair.
- *HSL Longest* interpolates the colors between nodes from the longest distance (clockwise or counterclockwise)on the Hue-Saturation-Luminosity color wheel between each node pair.

Data Value and Position

The *Data Value* displays the data value of the selected node. The *Position* field displays the node's relative position in the colormap where the colormap minimum *Position* is 0% and the maximum is 100%. The selected node may be accurately repositioned by entering a new value in the *Data Value* or percentage in the *Position* field. The first and last nodes cannot be changed and this control is disabled when an end node is selected. To change the first and last nodes, change the *Min* and *Max* values in the *Data* section.

The *Data Value* option is not used the same way with the classed post map. To determine the color in the colormap associated with each class, the following rules are used:

- The first class uses the *Minimum* value color. This is the node on the far left side of the colormap.
- Subtract the *Minimum* from the *Maximum* value and divide by the *Number of classes*. This is the separation value. Add the separation value to the *Minimum* value. This will be the value color associated with the next class.
- Add the separation value to the previous value. This is the value color associated with the next class.
- Repeat adding the separation value to the previous value until only the last class remains. The last class uses the *Maximum* value color. This is the node on the far right side of the colormap.
- Grapher automatically interprets the colormap to determine the color value associated with each class. Any number of nodes can exist on the colormap. The nodes and the *Value* in the colormap are not associated with the classes.

Color

Click the *Color* box to specify the color of the currently selected anchor node. The color palette opens.

Data Histogram

A data histogram is displayed in both the *Color Mapping* and *Opacity Mapping* sections. The histogram consists of equal width bins between the data minimum and data maximum. The number of bins is the number of data points or 256, whichever is fewer.

- For most grid-based maps, the grid Z values are used to create the histogram.
- For base map symbology, the selected *Attribute field* data is used to create the histogram.
- For vector maps with magnitude scaling, the vector magnitude data is used to create the histogram. The magnitude will be calculated in the case of 1-grid vector and Cartesian 2-grid vector maps. The magnitude is used from the magnitude grid directly in the case of a polar 2-grid vector map. For vector maps with grid scaling, the Z values from the selected grid are used to create the histogram.
- For point cloud maps, the data selected in the *View by* property is used to create the histogram.

When the *Logarithmic scaling* option is selected in the *Data* section, the histogram bins are calculated from the log of the data values. This ensures the histogram remains aligned with the colormap when *Logarithmic scaling* is selected. This scales the X axis (bins).

You can also logarithmically scale the Y axis (frequency) values. This option is useful when only a few bins contain most of the data values. Logarithmic scaling the Y axis will show more detail in the histogram. To apply logarithmic scaling to the Y axis, right-click either of the data histograms and select **Logarithmic Scale** in the context menu. To return to linear scaling on the Y axis, right-click either of the data histograms and select **Linear Scale**.

In the *Color Mapping* section, the colormap anchor nodes are displayed above the data histogram. An anchor node's horizontal position corresponds to its *Data Value* and *Position*.

Colormap Example

The sample of the generated colormap is display directly below the histogram and anchor nodes.

Anchor Nodes

Anchor nodes are displayed directly above the data histogram. Anchor nodes specify a color and position in the *Color Mapping* section. Anchor nodes specify an opacity and position in the *Opacity Mapping* section.

You can add additional anchor nodes at any position along the colormap. To create a new anchor node, double-click on the data histogram where you want the new node added. In the *Color Mapping* section, the new anchor is automatically assigned a *Color* based on the previous colormap, and the *Data Value* is assigned based on where you clicked. In the *Opacity Mapping* section the new anchor is assigned the *Opacity* and *Data Value* corresponding to the exact location you clicked. You can add as many anchor nodes as you want. This lets you blend colors and opacities in many different ways on the colormap.

Left-click on an anchor node and press the DELETE key on the keyboard to delete a node. The first (far left) and last (far right) anchor nodes cannot be deleted.

Scroll Control

The scroll control appears as a horizontal bar with end handles. Drag a handle left or right to zoom the colormap and histogram in or out. Drag the center section to scroll the visible portion left or right. Double-click the center section to return it to the fully visible state. The scroll control changes the view of both the *Color Mapping* and *Opacity Mapping* sections.

Use the scroll control to zoom the colormap in or out.

Opacity Mapping

The *Opacity Mapping* section contains the opacity mapping controls. These controls specify how a range of data values are mapped to opacity in the final output. Note that opacity is the opposite of transparency (0.0 is completely transparent, 1.0 is completely opaque).

Presets

The options in the *Presets* list may be used to preset the opacity settings which can then be modified as desired.

- *Fixed 100%* sets the entire data range to a fixed opacity of 100% (fully opaque).
- *Fixed 20%* sets the entire range of data to a fixed opacity of 20%.
- *Ramp 0 to 100%* sets the data *Min* value to an opacity of 0% and the data *Max* value to an opacity of 100%. The opacity increases linearly from 0% to 100% throughout the data range.
- *Ramp 0 to 20%* sets the data *Min* value to an opacity of 0% and the data *Max* value to an opacity of 20%. The opacity increases linearly

from 0% to 20% throughout the data range.

- *Middle Ramp* sets the lowest (fourth) quartile to 0% opacity, followed by a linear ramp over the third and second quartiles, followed by a fixed opacity of 100% for the greatest (first) quartile.
- *Custom* is displayed automatically when a node is selected, created, removed, or the *Opacity* value or *Data Value* options are adjusted.

Data Value

The *Data Value* displays the data value of the selected node. The *Position* field displays the node's relative position in the colormap where the colormap minimum *Position* is 0% and the maximum is 100%. The selected node may be accurately repositioned by entering a new value in the *Data Value* or percentage in the *Position* field. The first and last nodes cannot be changed and this control is disabled when an end node is selected. To change the first and last nodes, change the *Min* and *Max* values in the *Data* section.

Level Ends

Check the *Level Ends* box to level the first and last segments of the opacity graph. When the nodes at one end of a level segment are dragged up or down, the other end is also dragged.

Opacity

Specify the opacity for the selected node in the *Opacity* field. The *Opacity* value ranges from 0.00% (completely transparent) to 100.00% (completely opaque). To change the opacity, click on one of the nodes. Then, highlight the existing value and type a new value or click the button to increase or decrease the opacity for the selected node.

Data Histogram

The *Opacity Mapping* section includes a data histogram. See the *Color Mapping* section above for the histogram description. Opacity anchor nodes are displayed on the data histogram. An anchor node's vertical position corresponds to its *Opacity*. An anchor node's horizontal position corresponds to its *Data Value* and *Position*.

Data

The *Data* section contains options for setting the minimum and maximum data values and scaling to use in the colormap.

Use Data Limits

Check the *Use data limits* check box to use the data minimum and maximum values. This option is not available for classed post maps.

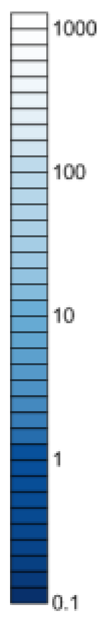
Colormap Data Minimum and Maximum

If you would prefer to set the colormap minimum and maximum values, enter the new numbers into the *Min* and *Max* boxes. This is useful when you are mapping different data sets in a similar range and would like to have the same data values represented by the same colors in each map. If a data value within the map falls outside this range, it is assigned the minimum or maximum color, whichever is closest.

The minimum and maximum values cannot be set for the classed post map. For the classed post map, the far left *Min* node is always the median value for the first class. The far right *Max* node is always the median value for the last class. This cannot be changed.

Logarithmic Scaling

Check the box next to the *Logarithmic scaling* to set the intervals between the nodes to a log(10) scale. The *Min* and *Max* values are the same. The nodes between the minimum and maximum and the color definitions adjust to fit the log(10) scale. On a log(10) scale, there is as much distance on the colormap sample between 1 and 10 as between 10 and 100 or 100 and 1000. In the example below, the nodes are displayed at 0.1, 1, 10, 100, and 1000. To use a regular linear scale on the colormap, clear the box next to *Logarithmic scaling.*



The associated color scale bar is shown with the major log intervals displayed.

Loading a Colormap

The *Load* button opens an existing colormap .CLR file. When you click the *Load* button, the **Open** dialog is displayed with a list of colormap files. Click the file you want to use and click *Open*. The colormap is updated to show the colormap file settings.

Colormap files can be used with maps of varying Z ranges since the anchor nodes are stored as percentages rather than as data values. To use the exact same colors in the exact same data locations when the Z ranges vary slightly, override the default data limits and assign custom values in the *Data to Color Mapping* group.

Saving a Colormap

Click the *Save* button in the **Colormap Editor** to create a colormap .CLR file based on the current colormap settings. When you click the *Save* button, the **Save As** dialog is displayed. Type the *File name* for the colormap file and click *Save*. The file is saved for use with other files.

Anchor Nodes

The color spectrum is defined by anchor nodes at user-defined points along a color spectrum in the Colormap Editor. Colors and opacities are automatically blended between adjacent anchors. Anchor nodes are represented by a slider button along a line on the *Color Mapping* and *Opacity Mapping* data histograms.

Anchor Node Value

The data value for the node is displayed in the *Data Value* box. Except for the first and last nodes, any node can be assigned to a specific value by typing a new number into the *Data Value* box. The first and last node data values are controlled by the *Min* and *Max* in the *Data* section.

Add Anchor Node

You can add additional anchor nodes at any position along the colormap. To create a new anchor node, double-click on the data histogram where you want the new node added. In the *Color Mapping* section, the new anchor is assigned a *Color* and *Data Value* based on where you clicked. In the *Opacity Mapping* section, the new anchor is assigned an *Opacity* and *Data Value* corresponding to the exact location you clicked. You can add as many anchor nodes as you want. This lets you blend colors and opacities in many different ways on the colormap.

Delete Anchor Node

Left-click on an anchor node and press the DELETE key on the keyboard to delete a node. The first (far left) and last (far right) anchor nodes cannot be deleted.

Positioning a Color Anchor Node

To position an anchor node:

1. Move the mouse cursor over the slider button.
2. Click and hold the left mouse button.
3. Drag the slider button to the desired position and release the left mouse button. As you move the slider button left or right, the data value is indicated in the *Data Value* box. Alternatively, you can set the anchor to a specific data value by entering a number into the *Data Value* box. Note that the beginning and ending anchors cannot be moved or deleted.
4. Specify the *Min* and *Max* values in the *Data* section to change the range, and therefore, the position of the starting and ending nodes.

Selecting a Color for an Anchor

To select a color to associate with the anchor node in the *Color Mapping* section:

1. Click on the anchor you wish to modify.
2. Click on the desired color in the *Color* palette. The color spectrum is updated to indicate the change.

Alternatively, use a preset .CLR color file by selecting one of the options from the *Presets* list or click the *Load* button to load a custom .CLR file.

Positioning an Opacity Anchor Node

To position an anchor node:

1. Move the mouse cursor over the slider button.
2. Click and hold the left mouse button.
3. Drag the slider button to the desired position and release the left mouse button. As you move the slider button left or right, the data value is indicated in the *Data Value* box. Alternatively, you can set the anchor to a specific data value by entering a number into the *Data Value* box. As you move the slider button up or down, the *Opacity* value is increased or decreased. Alternatively, you can set the anchor to a specific value by typing a number in the *Opacity* box. Note that the beginning and ending anchors cannot be moved or deleted.
4. Specify the *Min* and *Max* values in the *Data* section to change the range, and therefore, the position of the starting and ending nodes.

Select an Opacity for an Anchor

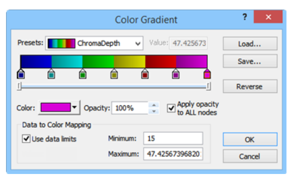
To select an opacity to associate with the anchor node in the *Opacity Mapping* section:

1. Click on the anchor you wish to modify.
2. Type the desired value in the *Opacity* field. The color spectrum is updated to indicate the change.

Alternatively, click and drag the anchor node up or down, use a preset .CLR color file by selecting one of the options from the *Presets*list, or click the *Load*button to load a custom .CLR file.

Create Solid Colors in the Color Gradient

Solid colors can be generated in a gradient fill by placing two anchor nodes in the same location in the Color Gradient, similar to the *ChromaDepth* preset color spectrum. Notice that the *ChromaDepth* preset does not contain solid colors, but the same principal applies to creating solid colors.

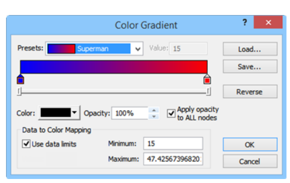


The ChromaDepth *color gradient preset appears to have seven anchor nodes,*

but thirteen anchor nodes are used to create the six colors.

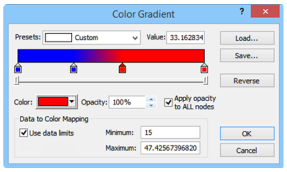
This example will demonstrate creating solid colors from the *Superman* preset. This method can be used to create solid colors within color gradients. To apply a gradient fill to a plot or object:

1. Change the *Type* property to *Linear* or *Radial* in the *Gradient* section of the **Property Manager** Fill page.
2. Click the button to open the Color Gradient dialog.



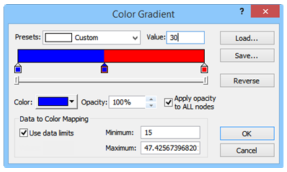
The default Superman *preset color gradient.*

3. Create a new anchor node by clicking in the color spectrum example. The new anchor node is selected automatically.
4. Change the *Color* to match the left anchor node, in this example the color is changed to *Blue*.
5. Create another new anchor node to the right of the recently created anchor node.
6. Change the second new anchor node *Color* to match the node to its right, *Red* in this example.



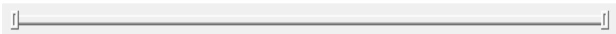
The two new anchor nodes have been created and color matched to the existing
anchor nodes. Notice the solid blue between the first and second nodes and the
solid red between the third and fourth nodes.

7. Now the new anchor nodes must be positioned in the same location. If the *Value* property is available, then the same value can be entered for each node. If the *Value* property is not available, then the anchor nodes must be clicked and dragged to the same location.
8. In this example each node is selected and the *Value* is changed to *30*.



The new anchor nodes are moved to the same location in the color spectrum which
creates a solid blue region and a solid red region.

If the *Value* property is not available, then the scroll control can be used to precisely place the new anchor nodes. Click and drag the ends of the scroll control bar to zoom in on a specific part of the color spectrum.



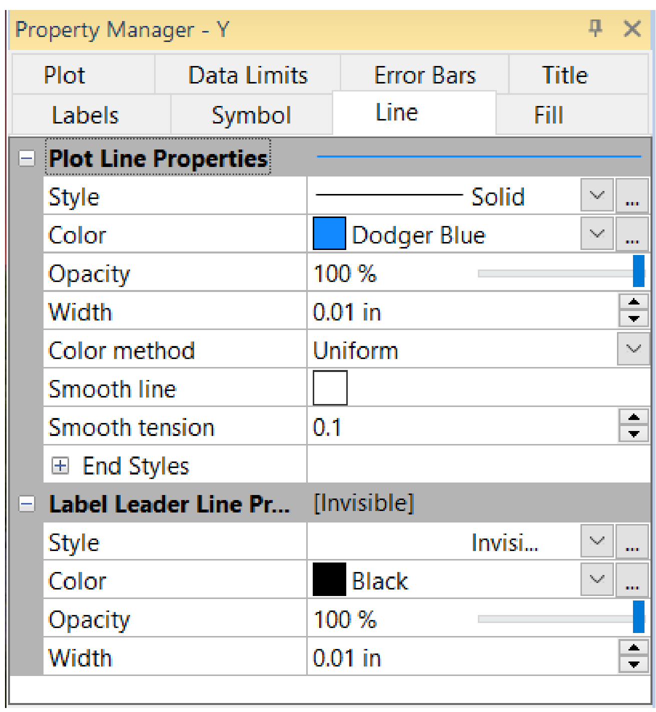
The scroll control can be used to change the view of the color spectrum example.

The color gradient now contains two solid colors. This process can be repeated to add more solid colors to the color gradient.

Line Properties

Line properties can be changed for selected objects. To edit the line properties, click on the object in the Object Manager or plot window. The properties are listed in the Property Manager on the **Line** tab.

The **Line** page in the **Property Manager** contains properties for all lines in the object. For example, a line/scatter plot **Line** page will include a *Plot Line Properties* section. The **Line** page will also include a *Label Leader Line Properties* section. The **Line** page for an axis can contain four sections: *Axis Line Properties*, *Ticks Line Properties*, *Grid Line Properties*, and *Label Leader Line Properties*.



*Set the line properties in the **Property Manager** on the **Line** tab.*

Sample

The sample of the line is displayed next to *Line Properties*. The sample shows the line style, color, opacity, and width options.

If the *Line Properties* section is closed, click the ⊞ next to *Line Properties* to open the section.

Style

The *Style* is the manner in which a line is drawn. To change the *Style,* click on the existing line next to *Style.*Theline style palette opens. Click on a style to use it for the selected line. To create a custom line style, click the ... button at the right of the line style to open the Custom Line dialog, where you can create new line styles.

3D lines do not support the complex line styles. The standard line styles and custom line styles can still be used with 3D lines.

Color

The *Color* is the color of the line. Click the existing color sample next to *Color* to open the color palette. Click on a color in the palette to use it for the selected line. To create a custom color, click the ... button at the right of the color sample to open the Colors dialog.

Opacity

The *Opacity* controls the transparency of the line. To change the *Opacity*, highlight the existing value and type a new value. Press ENTER on the key-board to make the change. Alternatively, click and drag the to change the opacity percentage. Opacity values are between 0% (zero opacity, full transparency) to 100% (full opacity, zero transparency).

Width

The *Width* controls how a line appears. To change the line *Width,* highlight the existing value and type a new number. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the thickness of the line. The line *Width* is a value from 0.0 to 0.5 inches (0.0 to 1.27 cm). A width of zero is one pixel wide. Values are in page coordin-ates.

Line Color Method

Colors can be applied to lines in various ways. The *Line color method* property defines which method is used to color the line:

- *Uniform*, where one color is used for the entire line
- *Color variable*, where line segment colors are specified by a color variable.
- *Colormap*, where the color is varied along the line by a color gradient.

Color Variable

When *Color variable* is selected, the *Color variable* is a column/row in the worksheet that contains a color specification. The color of the line segment changes based on the color in the worksheet column. The line color stays the selected new color until another color change is specified. To change the *Line color variable*, click the existing column or the word *None*. Select any other column in the worksheet.

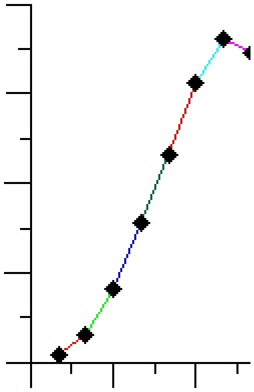
Colors can be specified in the worksheet by many different methods.

Method	**Example**
<color>	Red
<color>:<a>	Red:255
RGB(<r>,<g>,<b>)	RGB(255,0,0)
\COLOR(<r>,<g>,<b>,<a>)	\COLOR(255,0,0,255)
R<r> G<g> B<b>	R255 G0 B0
R<r> G<g> B<b> A<a>	R255 G0 B0 A255
\RGBR<r> \RGBG<g> \RGBB<b>	\RGBR255 \RGBG0 \RGBB0

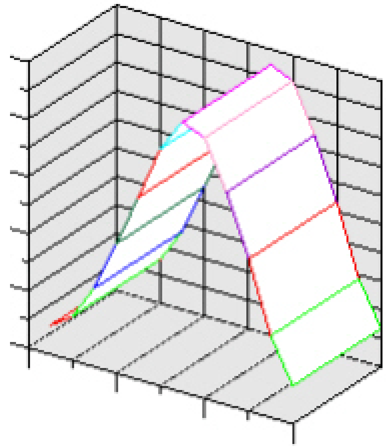
where <r>, <g>, <b>, and <a> are red, green, blue, and alpha values between 0 - 255 and <color> is a color name as it appears in the color palette.

Colormap

When *Colormap* is selected, the colormap is a color gradient that is distributed along the line from the first vertex to the last vertex. Select the desired color gradient in the *Colormap* property field.



This Line/Scatter Plot uses a Line color column in the worksheet to change the color of the line segments.



This 3D Ribbon/Wall plot uses a Line color column in the worksheet to change the color of the line segments.

End Styles

The ends of the lines can have arrowheads on them. To open the *End Styles* section, click the ⊞ next to *End Styles*. Some lines, for example 3D axis grid lines, do not support end styles.

The *Start* style is placed at the first vertex of the line. The *End* style is placed at the last vertex of a line. Not all lines can have arrowheads. For example, the line surrounding a rectangle does not support arrowheads. To change the *Start* or *End* style, click on the current option and select the desired option from the list.

The *Scale* determines the size of the arrowhead. A larger *Scale* creates a larger arrow. To change the scale of the arrowheads, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the ⬍ to increase or decrease the scale. A value of 1 makes the arrow the default size.

Draw Arrows

The arrow on a 3D vector plot is displayed by default. The arrow can be turned off by unchecking the box next to the *Draw arrows* option. This option is only available for 3D vector plots. When checked, the arrow is displayed. When unchecked, the arrow is removed.

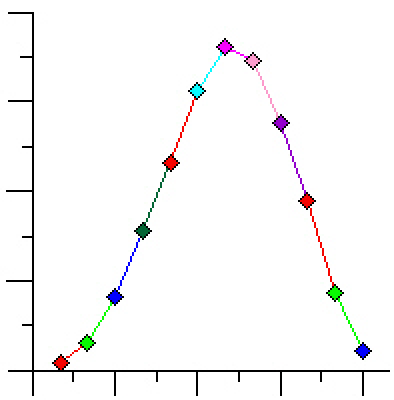
Smooth Line

Select the *Smooth line* option to spline smooth the connecting line in the line plot. Control the amount of smoothing by entering a value between 0 and 1 in the *Smooth tension* field. The smaller the *Smooth tension* value, the more curved the connecting line. You may need to increase the tension if your line plot has areas where the line crosses itself. Clear the *Smooth line* option to connect data points with a straight line. The smoothing may not be visible if a *Line color column* is selected.

Use Color For Symbols

When the *Line color column* is specified, the *Use color for symbols* option is available. Symbols use the same color as the *Line color column* when the box next to *Use color for symbols* option is checked. The color of the symbol is changed on the row where the symbol occurs. The symbol is the same color as the line that follows the symbol.

If the *Symbol table* option is selected on the **Symbol** tab, the colors are read from the symbol table and not from the *Line color column.*



This is the same Line/Scatter plot as above, with the Use color for symbols *option checked.*

Color Scaling

On a vector plot, polar vector plot, or 3D vector plot, check the box next to *Color scaling* to set the color of the vector based on the vector length. Set the colors to use for the vectors with the *Colormap* option. When the *Color scaling* option is unchecked, the *Color* option sets the color of all vectors.

Show Color Scale

On a vector plot, polar vector plot, or 3D vector plot, check the box next to the *Show color scale* command to show the vector map's color scale. Note: this option is disabled if the *Color scaling* box is not checked.

Colormap

The *Colormap* option sets the vector colors to be set from a color gradient. Click the existing color gradient and select the desired color gradient from the list. Click the ... button next to the color gradient to open the Color Gradient dialog. The *Colormap* option is disabled if the *Color scaling* option is not checked.

Surface Mesh Lines

Surface data maps, surface grid maps, and surface function maps can include a wireframe mesh on the surface represented by lines of constant X and lines of constant Z. The line properties are controlled independently in the *X mesh lines* and *Z mesh lines* sections.

Frequency

The *Frequency* defines how many mesh lines are shown on the surface map. This value must be equal to or greater than 1. The *Frequency* displays a line at every nth grid row or column. For example, a*Frequency* of 1 displays a line at every grid row or column and a *Frequency* of 3 displays every third line. To change the *Frequency*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, press the to increase or decrease the step value.

Line Properties

Edit the line properties for the mesh lines in the *Line Properties* section.

Axis Tick Line Properties

By default, tick marks have the same line properties as the axis line. Therefore, changing the axis line properties in the *Axis Line Properties* section also changes the tick mark line properties. You can override this setting and define unique line properties for the tick marks by setting the *Major tick line* and/or *Minor tick line* option to *Custom* and then setting the line properties in the following *Major tick line properties* or *Minor tick line properties* sections. To open sections, click the next to the section name.

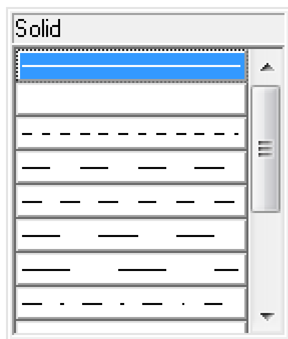
Default Line Properties

You can set default line properties through the File | Options command.

Line Palette

Click on a line to open the line palette.

- The name of the line appears at the top of the palette.
- Select a line style from the palette by clicking on a line.
- Create a custom line style by clicking the  button to the right of the selected line style. Saved custom line styles are displayed at the bottom of the line palette.



Use the line palette to select a line style.

Line Styles

Select a line style from the line palette.

Line Styles

Invisible	
Solid	
.1 in. Dash	
.2 in. Dash	
.3 in. Dash	
.4 in. Dash	
.5 in. Dash	
Dash Dot	
Dash Dot Dot	
Dash Dot	

Dot
Dash Dash Dot
Dash Dash Dot
Dash Dash Dot

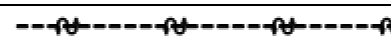
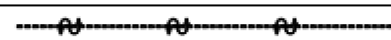
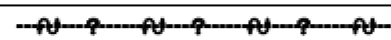
Complex Line Styles

Solid - Hollow squares
Solid - Hollow half squares, right
Solid - Ticks
Solid - Half ticks, alternating
Solid - Double ticks
Solid - Double half ticks, alternating
Solid - Half ticks, right
Solid - Double half ticks, right
Solid - Circles
Solid - Squares 1
Solid - Squares 2
Solid - Half squares, left
Solid - Half squares, right
Solid - Diamonds
Solid - Triangles
Solid - Half ovals
Solid - Dashes
Solid - Arrow, left
Solid - Back arrow, left
Solid thin - Half ticks, right
Double solid
Double solid - Ticks 1
Double solid - Ticks 2
Double solid - Double half ticks, right
Double solid - Interior ticks
Double solid - Circles
Double solid - Squares

Double solid - Diamonds
Double solid - Triangles
Double solid - Dashes
Double solid, thin
Double solid, thin - Ticks
Double solid, thin - Interior ticks
Triple solid
Triple solid - Interior ticks
Triple solid, thin
Long dash - Ticks
Long dash - Double ticks
Long dash - Pluses
Double long dash
Medium dash - Half ticks, alternating
Medium dash - Half ticks, right
Medium dash - Half ticks, left
Medium dash - Double half ticks, right
Medium dash - Double half ticks, left
Medium dash - Double half ticks, alternating
Medium dash - Circles
Medium dash - Diamonds
Medium dash - Triangles
Medium dash - Ovals
Medium dash - Squares
Long barbell
Medium barbell
No line - Ticks
No line - Chevrons
No line - Chevrons, reversed
No line - Circles
No line - Triangles
No line - Diamonds
No line - Squares
Medium dash, wide

Short dash, wide	
Dash/dot, wide	
Dash/dot/dot, wide	
Scallop	
Wave	
Square wave	
Wavy dash	
Double wavy dash	
Wavy dash, queried	
Warm front	
Cold front	
Stationary front	
Occluded front	
Fault - Approximately located, queried	
Fault - Inferred, queried	
Fault - Concealed, queried	
Fault - Upthrown/Downthrown	
Strike-slip fault, left-lateral offset - Certain	
Strike-slip fault, right-lateral offset - Certain	
Thrust fault, 1st generation - Certain	
Thrust fault, 1st generation - Approximately located	
Thrust fault, 1st generation - Approximately located, queried	
Thrust fault, 1st generation - Inferred	
Thrust fault, 1st generation - Inferred, queried	
Thrust fault, 1st generation - Concealed	
Thrust fault, 1st generation - Concealed, queried	
Thrust fault, 2nd generation - Certain	
Thrust fault, 2nd generation - Approximately located	
Thrust fault, 2nd generation - Approximately located, queried	
Thrust fault, 2nd generation - Inferred	

Thrust fault, 2nd generation - Inferred, queried
Thrust fault, 2nd generation - Concealed
Thrust fault, 2nd generation - Concealed, queried
Detachment fault, type 1, 1st generation - Certain
Detachment fault, type 1, 1st generation - Approximately located
Detachment fault, type 1, 1st generation - Approximately located, queried
Detachment fault, type 1, 1st generation - Inferred
Detachment fault, type 1, 1st generation - Inferred, queried
Detachment fault, type 1, 1st generation - Concealed
Detachment fault, type 1, 1st generation - Concealed, queried
Anticline - Certain
Anticline - Approximately located
Anticline - Approximately located, queried
Anticline - Inferred
Anticline - Inferred, queried
Anticline - Concealed
Anticline - Concealed, queried
Overturned anticline - Certain
Overturned anticline - Approximately located
Overturned anticline - Approximately located, queried
Overturned anticline - Inferred
Overturned anticline - Inferred, queried
Overturned anticline - Concealed
Overturned anticline - Concealed, queried
Inverted anticline - Certain

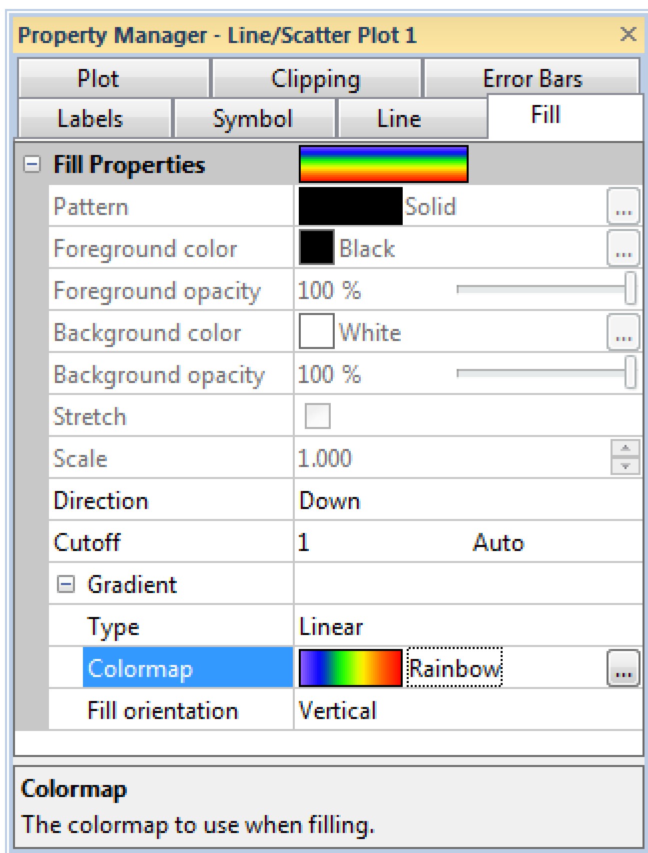
Inverted anticline - Approximately located	
Inverted anticline - Approximately located, queried	
Inverted anticline - Inferred	
Inverted anticline - Inferred, queried	
Inverted anticline - Concealed	
Inverted anticline - Concealed, queried	
Syncline - Certain	
Syncline - Approximately located	
Syncline - Approximately located, queried	
Syncline - Inferred	
Syncline - Inferred, queried	
Syncline - Concealed	
Syncline - Concealed, queried	
Overturned syncline - Certain	
Overturned syncline - Approximately located	
Overturned syncline - Approximately located, queried	
Overturned syncline - Inferred	
Overturned syncline - Inferred, queried	
Overturned syncline - Concealed	
Overturned syncline - Concealed, queried	
Inverted syncline - Certain	
Inverted syncline - Approximately located	
Inverted syncline - Approximately located, queried	
Inverted syncline - Inferred	
Inverted syncline - Inferred, queried	
Inverted syncline - Concealed	
Inverted syncline - Concealed, queried	
Dipping Bed - Certain	
Dipping Bed - Approximately located	
Dipping Bed - Approximately located,	

queried	
Dipping Bed - Inferred	
Dipping Bed - Inferred, queried	
Dipping Bed - Concealed	
Dipping Bed - Concealed, queried	
Overturned Bed - Certain	

Fill Properties

Fill properties can be changed for selected objects. To edit the fill properties, click on the object in the Object Manager or plot window. The properties are listed in the Property Manager on the **Fill** tab.

The **Fill** page in the **Property Manager** contains properties for all fills in the object. For example, a 3D ribbon/wall plot **Fill** page will include a *Ribbon Fill Properties* section for the ribbon fill, an *Error Bar Fill Properties* section for the error bar fill, and a *Wall Fill Properties* section for the wall fill.



*The fill properties are set in the **Property***

***Manager** on the **Fill** tab.*

Sample

The sample shown next to the *Fill Properties* line shows the selected pattern, foreground color, and background color.

Pattern

The *Pattern* indicates the way that an object is filled. To change the *Pattern,* click on the existing pattern sample next to *Pattern*. In the list, select a new pattern from the fill palette. There are two types of fill patterns: Windows stock and bitmap images. Stock patterns and some bitmap patterns can have different foreground and background colors. All patterns can have the foreground or background color partially transparent.

Bitmap patterns can be scaled. Bitmap patterns are not available for contour maps, or surface maps. Click the ... to the right of the *Pattern* to import an image to use as a bitmap fill. For bar charts, you may wish to use the *Image* bar Bar style rather than a bitmap fill.

Foreground Color

The Foreground color is the color of the pattern lines or pixels. Click the existing color sample next to *Foreground color* to open the color palette. Click on a color in the palette to use it for the selected foreground fill color. Click the ... button to the right of the color sample to open the **Colors** dialog, setting a custom color.

Foreground Opacity

The *Foreground opacity* controls the transparency of the foreground portion of the pattern. To change the *ForegroundOpacity*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click and drag the slider to change the opacity percentage. Opacity values are between 0% (zero opacity, full transparency) to 100% (full opacity, zero transparency).

Background Color

The Background color is the color behind the pattern. All patterns must have a background color. If you do not wish to see the background color, change the *Background opacity* to 0%. Click the existing color sample next to *Background color* to open the color palette. Click on a color in the palette to use it for the selected foreground fill color. Click the ... button to the right of the color sample to open the **Colors** dialog, setting a custom color.

Background Opacity

The *Background opacity* controls the transparency of the background portion of the pattern. To change the *Background opacity*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click and drag the  to change the opacity percentage. Opacity values are between 0% (zero opacity, full transparency) to 100% (full opacity, zero transparency).

To make a fill pattern appear transparent with only the foreground portion of the fill pattern showing, change the *Background opacity*value to 0%.

Stretch

Check the *Stretch* option to stretch image fills to completely fill the geometry. If *Stretch* is not selected, the image will be repeated to fill the geometry.

Scale

The*Scale*controls the density of the bitmap fill*Pattern*. Clear the box next to the *Stretch* option and set the *Scale* factor to a value between 0.1 and 10. The larger the *Scale*, the larger the resulting pattern.

Direction

You can fill the plot in one of four directions by selecting one of the following from the *Direction* list. *Down* fills the area under the curve to the minimum Y *Cutoff* value. *Up* fills the area above the curve to the maximum Y *Cutoff* value. *Left* fills the area to the left of the curve to the minimum X *Cutoff* value. *Right* fills the area to the right of the curve to the maximum X *Cutoff* value.

When a Between Fill plots is used, the *Direction* options allow you to specify *Horizontal* or *Vertical*.

Cutoff

The *Cutoff* value controls the limits of the fill. To set the *Cutoff* value, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. To return the *Cutoff*to the default value, click the word*Custom*and it will return to*Auto*. When the*Cutoff*is set to*Auto*, the value is the minimum or maximum axis value.

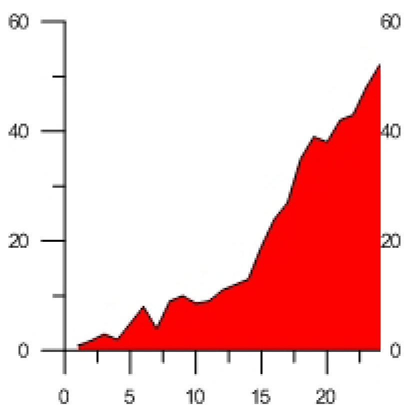
For example, if *Up* is the selected *Direction* and the *Cutoff*is set to*Auto*, the fill will go to the Y axis maximum value. If 20 is entered as the *Cutoff*, the fill is above the curve to the Y Axis value of 20. Any area above the curve that is greater than the Y Axis value of 20 is not filled.

Gradient

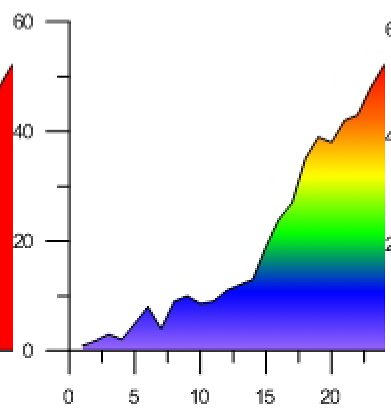
The *Gradient* section sets the fill pattern to a gradient fill.

Gradient Type

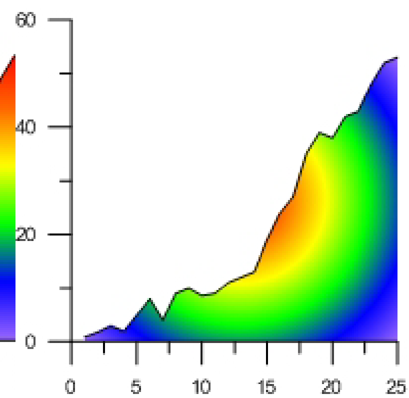
The *Type* controls whether a gradient fill pattern is used to fill the selected area. To change the *Type*, click on the current type and select the new type in the list. Select *None, Linear,* or *Radial* for the *Type*. When the *Type* is set to *None,* the gradient fill options are disabled. The fill is determined by the *Pattern, Foreground,* and *Background* options. When the *Type* is set to *Linear,* a linear color gradient fills the area. The colors change in a linear manner from the top to the bottom or from the left to the right of the area. When the *Type* is set to *Radial,* a radial color gradient fills the area. The colors change in concentric circles, either expanding from the interior and going out or from the exterior and going in. Some 3D objects, such as 3D bar charts, do not support *Radial* gradient fill.



This example has Type *set to None.*



This example has Type *set to Linear.*



This example has Type *set to Radial.*

Colormap

The *Colormap* option fills the graph components with a color gradient. Click the existing color gradient and select the desired predefined gradient from the list. Click the button to the right of the color gradient to open the Color Gradient dialog. This option is disabled if the *Type* is set to *None*.

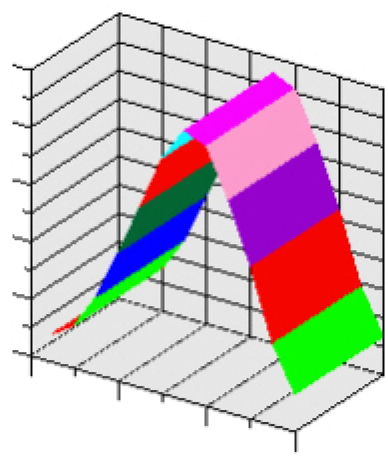
Fill Orientation

The *Fill orientation* option sets the direction the gradient fills. When the *Type* is set to *Linear*, choose either *Vertical* or *Horizontal* for the *Fill orientation.* The *Vertical* option sets the gradient to change along the Y axis. The *Horizontal* option sets the gradient to change along the X axis. When *Radial* is selected as the *Type*, the *Fill orientation* options are *Inward* and *Outward*. This reverses the color direction. The *Fill orientation* option is not available when the *Type* is set to *None*.

The color gradient can be mapped to plot values when the *Fill orientation* is set to *Linear*. However the *Data to Color Mapping* section of the **Color Gradient** dialog is not available when the *Fill orientation* is set to *Radial*.

Use Plot Line Color for Ribbon Fill

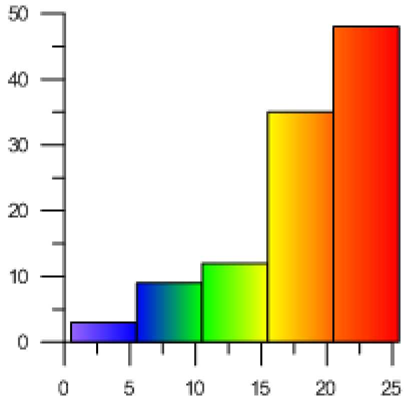
For 3D XYY ribbon/wall plots, when the Line *Color column* is specified, the *Use plot line color for ribbon fill* option is available. The ribbon uses the same color as the *Color column* when the *Use plot line color for ribbon fill* option is checked.



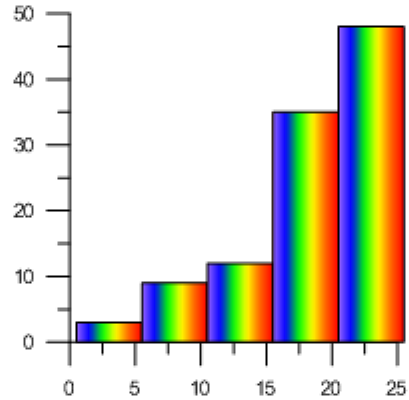
The ribbon segments are filled with the same color as the line segments.

Spread Across Plot

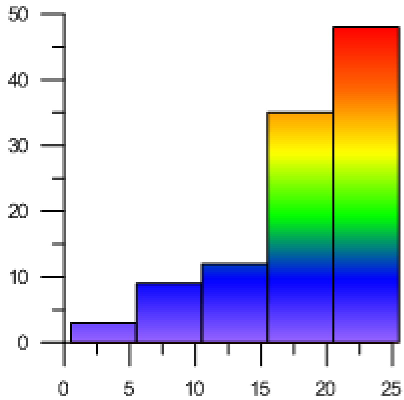
The *Spread across plot* option is only available for 2D and 3D XYY bar charts, floating bar charts, and histogram plots. When this option is checked, the gradient fills across the entire plot rather than on a bar basis for histograms, bar charts, and floating bar charts. The spindle and diamond bar types do not support this feature in 3D charts.



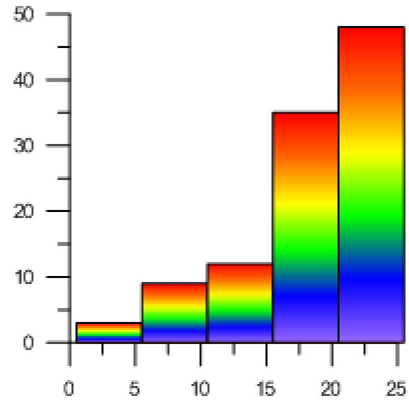
This example has Spread across plot *option checked with Horizontal as the* Fill orientation*.*



This example has Spread across plot *option cleared with Horizontal as the* Fill orientation*. Each bar is individually filled with the gradient.*



This example has Spread across plot *option checked with Vertical as the* Fill orientation*.*



This example has Spread across plot *option cleared with Vertical as the* Fill orientation*. The bars are individually filled with the gradient.*

Filling Bar Charts with Color Column

The *Color column* option is available to 2D bar charts, floating bar charts, histograms, polar bar charts, box-whisker plots, bubble plots, 3D XYY bar charts, floating bar charts, histograms, 3D XYZ bar charts, and floating bar charts. The *Color column* option allows you to select colors from a specific column in the worksheet to use as the *Foreground* color. Each bar is colored from the designated worksheet column. If a worksheet row does not have a color specified, the *Foreground* color is used for that bar.

Colors can be specified in the worksheet by many different methods.

Method	Example
<color>	Red
<color>:<a>	Red:255
RGB(<r>,<g>,<b>)	RGB(255,0,0)
\COLOR(<r>,<g>,<b>,<a>)	\COLOR(255,0,0,255)
R<r> G<g> B<b>	R255 G0 B0
R<r> G<g> B<b> A<a>	R255 G0 B0 A255
\RGBR<r> \RGBG<g> \RGBB<b>	\RGBR255 \RGBG0 \RGBB0

where <r>, <g>, <b>, and <a> are red, green, blue, and alpha values between 0 - 255 and <color> is a color name as it appears in the color palette.

Filling Bar Charts with Color Table

Check the box next to *Use color table* to specify the bar chart bar color from a color table. The *Color table* option becomes active. Uncheck the box next to *Use color table* to turn off the color table functionality. A color table can allow each bar to use a separate color and fill property or the a repeating color and fill property. The Color Table dialog allows you to assign a color to each bar in the chart.

Color Table

Click the *Set* button next to *Color table* to open the Color Table dialog and control which colors are used in the graph.

Show Color Table Legend

Select the *Show color table legend* property to display a color table legend.

Different Fill for Bars

Select the *Different fill if bars<base* to add a second *Fill Properties* section. The *Fill Properties (bars>base)* section controls the fill colors for the bars that extend up from the base value. The *Fill Properties (bars<base)* section controls the fill colors for the bars that extend down from the base value.

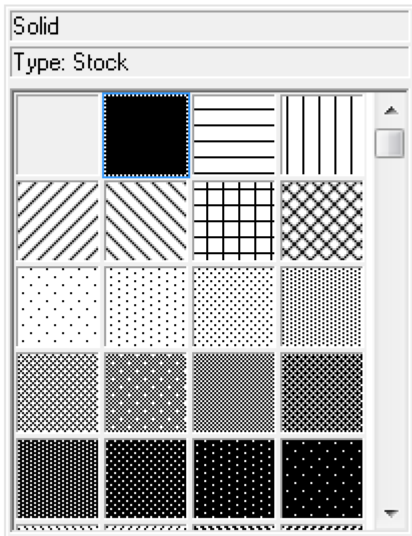
Default Fill Properties

You can set most default fill properties in the *Defaults*section of the File | Options command.

Fill Palette

Click the fill *Pattern* to open the fill pattern palette.

- Click on a pattern to select it.
- The name of the selected pattern appears at the top of the palette.
- The type of selected pattern appears beneath the pattern name.
- Use the scroll bar to see all of the available fill patterns.
- Load a custom image for a fill pattern by clicking the  button to the right of the selected pattern.



Use the fill palette to select a fill.

Fill Patterns

There are 315 predefined fill patterns. There are stock patterns and high resolution bitmap fill patterns. Bitmap patterns can be scaled and offset in the **Fill Properties**. Imported color images and USGS rocky type patterns cannot have transparency. Some image patterns can be transparent, if the global opacity level is changed when drawing the object. Select a pattern from the fill palette.

Stock Windows Patterns

None	90 Percent	Large Confetti
Solid	Light Downward Diagonal	ZigZag
Horizontal	Light Upward Diagonal	Wave
Vertical	Dark Downward Diag-	Diagonal Brick

	onal	
Forward Slash	Dark Upward Diagonal	Horizontal Brick
Backward Slash	Wide Downward Diagonal	Weave
Crosshatch	Wide Upward Diagonal	Plaid
Diagonal Cross	Light Vertical	Divot
5 Percent	Light Horizontal	Dotted Grid
10 Percent	Narrow Vertical	Dotted Diamond
20 Percent	Narrow Horizontal	Shingle
25 Percent	Dark Vertical	Trellis
30 Percent	Dark Horizontal	Spheres
40 Percent	Dashed Downward Diagonal	Small Grid
50 Percent	Dashed Upward Diagonal	Small Checkerboard
60 Percent	Dashed Horizontal	Checkerboard
70 Percent	Dashed Vertical	Outlined Diamond
75 Percent	Small Confetti	Solid Diamond
80 Percent		

Bitmap Patterns

6.25% Black	USGS 217	Clastic limestone
12.5% Black	USGS 218	Fossiliferous limestone
87.5% Black	USGS 219	Nodular bedded limestone
Dolomite2	USGS 226	Limestone w/ saccharoidal
Forest	USGS 228	Crossbedded limestone
Granite	USGS 229	Cherty crossbedded limestone
Gravel2	USGS 230	Cherty clastic limestone
Igneous	USGS 231	Oolitic limestone
Iron	Intrusive igneous 1	Sandy limestone
Orchard	Intrusive igneous 2	Silty limestone
Schist2	Intrusive igneous 3	Argillaceous shaly limestone

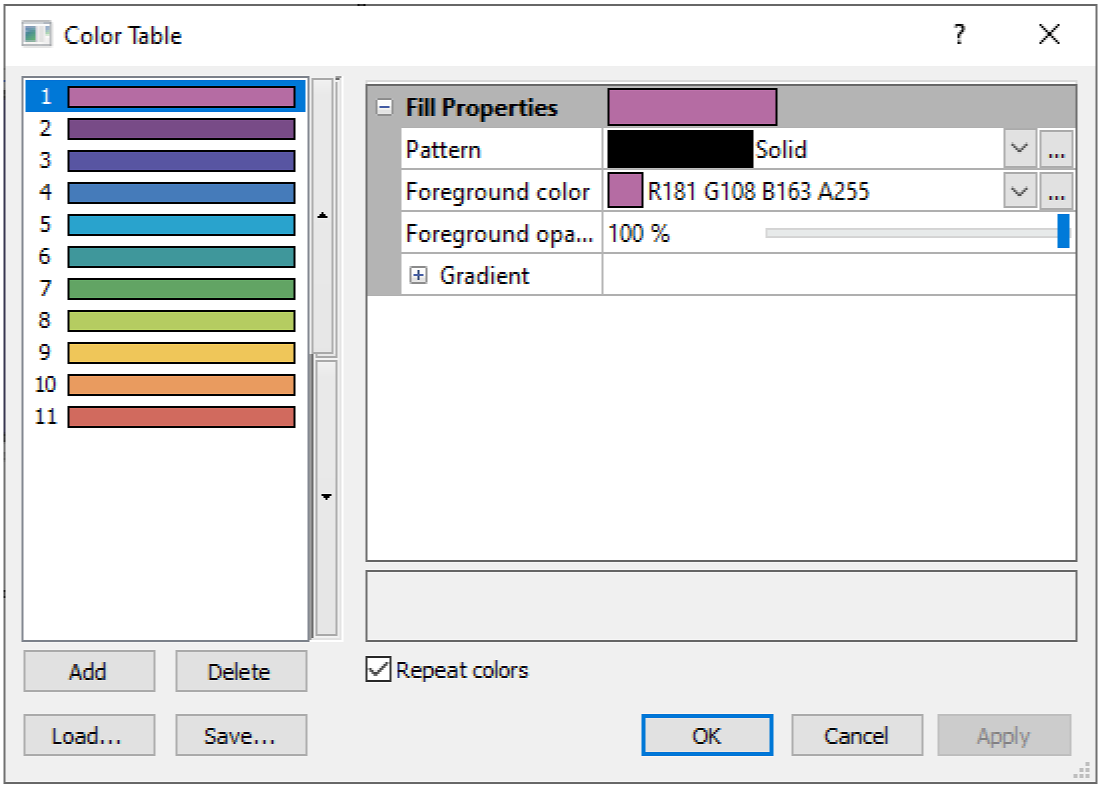
Shale	Intrusive igneous 4	Cherty limestone 1
Solid Dash	Basalt	Cherty limestone 2
Swamp	Basalt 3	Dolomitic limestone
Thatch	Basalt 4	Dolomite USGS
Water	Greenschist	Crossbedded dolo-mite
Andesite 1	Greenschist 2	Oolitic dolomite
Andesite 2	Diorite	Sandy dolomite
Andesite 3	Granodiorite	Silty dolomite
Basalt 1	Granodiorite 2	Argillaceous dolomite
Basalt 2	Granodiorite 3	Cherty dolomite
Conglomerate	Hornfels	Bedded chert 1
Dolomite	Hornfels 2	Bedded chert 2
Fish Fossil	Carbonatite	Fossiliferous bedded chert
Gneiss 1	Kimberlite	Fossiliferous rock
Gneiss 2	Rhyolite USGS	Diatomaceous rock
Granite1	Rhyolite USGS 2	Subgraywacke
Granite 2	Dacite	Crossbedded sub-graywacke
Gravel	Salt 1	Ripple-bedded sub-graywacke
Limestone - Fossil 1	Salt 2	Peat
Limestone - Fossil 2	Volcanic A	Bony coal
Limestone - Oolitic	Volcanic B	Underclay
Limestone - Sto-matolitic	Bedded tilted sand-stone	Flint clay
Limestone	Sandy gravel	Bentonite
Mudstone	Volcanic tuff	Glaconite
Quartzite	Rhyolitic tuff	Limonite
Rhyolite	Algal mats	Siderite
Rocks	Lignite	Phosphatic rock
Sand 1	Fine, poorly-graded sand 2	Gypsum
Sand 2	claystone	Salt 3
Sandstone 1	Marsh	Interbedded sand-stone
Sandstone 2	Dendrites	Interbedded sand-stone 2

Schist	Calc-silicate	Ripple-bedded sand-stone
Slate	Oolite	Interbedded shale
Stones	Med unconsolidated sediment	Interbedded shale 2
White Marble	Fine unconsolidated sediment	Interbedded shale 3
BIF	Jointed/Fractured rock	Interbedded cal-careous shale
Black Marble	Gneiss USGS 2	Interbedded silty lime-stone
Gneiss 3	Gneiss USGS	Interbedded lime-stone 1
Granite 3	Clastic dike	Interbedded lime-stone 2
Granite 4	Glacial-1	Interbedded lime-stone 3
Granite 5	Glacial-2	Interbedded lime-stone 4
Green Marble	Periglacial-1	Metamorphism
Orbicular Granite	Periglacial-2	Quartzite USGS
Oxidized Zone	Periglacial-3	Slate USGS
Pahoehoe	Periglacial-4	Schistonse
Pink Marble	Periglacial-5	Schist USGS
Pumice	Gravel or con-glomerate 1	Contorted schist
Ruby Zoisite	Gravel or con-glomerate 2	Schist and gneiss
Scoria	Crosbedded gravel	Gneiss
Zebra Dolomite	Till or diamicton	Contorted gneiss
Sand and Gravel	Breccia 1	Soapstone
Coarse sand	Breccia 2	Tuffaceous rock
Well graded coarse sand	Massive sand	Crystal tuff
Coarse, medium-graded sand	Bedded sand	Devitrified tuff
Coarse, well-graded sand	Crossbedded sand	Volcanic breccia and tuff
Coarse, well-graded sand 2	Crossbedded sand 2	Volcanic breccia
Fine, well-graded	Ripple-bedded sand	Zeolitic rock

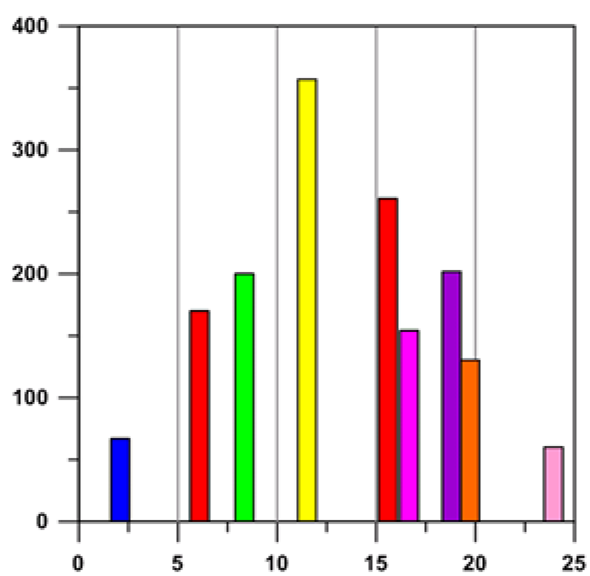
sand		
Fine, poorly-graded sand	Argillaceous sand-stone	Basaltic flows
Medium, poorly-graded sand	Calcareous sand-stone	Banded igneous rock
Coarse, cross-bedded sand	Dolomitic sandstone	Granite 2 USGS
Medium, poorly-graded sand 2	Loess	Igneous rock 1
Loose, medium-graded gravel	Silty shale	Igneous rock 2
Medium graded sand	Calcareous siltstone	Igneous rock 3
Coarse crossbedded gravel	Dolomitic siltstone	Igneous rock 4
Medium, well-sorted sand	Silty shale 2	Igneous rock 5
Inorganic silt 1	Clay shale	Igneous rock 6
Inorganic silt 2	Cherty shale	Igneous rock 7
Inorganic silt 3	Dolomitic shale	Igneous rock 8
Inorganic silt 4	Calcareous shale or marl	Porphyritic rock 1
USGS 207	Carbonaceous shale	Porphyritic rock 2
USGS 214	Oil shale	Vitrophyre
USGS 215	Chalk	Quartz
USGS 216	Limestone USGS	Ore

Color Table

Use the **Color Table** dialog to control which colors are used as the *Foreground* fill color for bar charts. The *Color table* option is enabled on the **Fill** tab of the Property Manager when the *Use color table* box is checked.



*Use the **Color Table** dialog to control which colors are used.*



*This bar chart is using the colors defined in the **Color Table** above for the bar color.*

Assigning Colors to the Color Table

The **Color Table** dialog allows you to specify the colors in the table. Click *Add* to add a color to the table. The color can be modified in the *Fill Properties* section of the **Color Table** dialog. Use the arrow buttons on the side of the color list to change the order of the colors. Click *Delete* to remove the selected color from the list.

Repeat Colors Option

Checking the box next to the *Repeat colors* option causes the colors to repeat throughout the chart whenever the end of the color list is reached. For example, if a bar chart has 20 bars and the color table being used has only 10 colors, the second set of 10 bars in the bar chart will use the same colors as the first 10 bars. When the*Repeat colors*option is unchecked, once the end of the color table is reached, the default fill color and properties are is used for the remaining bars.

Loading a Color Table

Click the *Load* button in the **Color Table** dialog to load an existing color table .GCT file. The **Open** dialog is displayed. Click the .GCT file you want to use and click the *Open*button. The color table is updated to show the color file settings.

Saving a Color Table

Click the *Save* button in the **Color Table** dialog to save the existing color table settings to a new color table .GCT file. When you click the *Save* button, the **Save As** dialog is displayed. Type the *File name* for the color file and click the *Save* button. The file is saved for use with other plots.

OK, Apply, Cancel

After you have made all of your changes, click the *Apply* button to apply the changes without exiting the **Color Table** dialog. The plot updates to show the changes, while the dialog is still displayed. Click the *OK* button to save your changes and close the **Color Table** dialog. Click the *Cancel* button to exit the **Color Table** dialog without saving your changes.

Color Palette

The color palette is opened by clicking the color sample or button.

- The name of the color appears at the top of the palette.
- Select a color from the palette by clicking on a color.
- Create a custom colors by clicking the ... button to the right of the selected color.

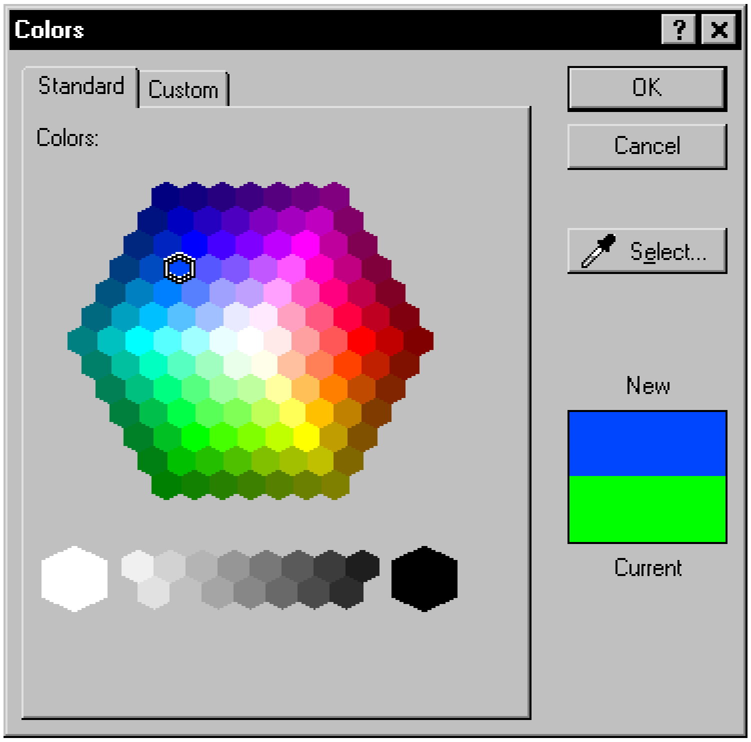
Use the color palette to select a color.

Custom Colors - Standard Page

In the **Property Manager**, click the  button to the right of the selected color to open the **Colors** dialog and select a standard color or create new colors. Select a color from the standard color palette on the **Standard** page. Create new colors by adjusting *Hue, Sat, Lum, Red, Green,* and *Blue* values on the Custom page.

Standard Page

The standard colors appear on the **Standard** page in a standard palette spectrum.



*Use the **Colors** dialog,.**Standard**page*
to load standard colors from the palette.

Colors
Click a color in the standard palette spectrum.

New
A preview of the selected color appears under *New* on the right side of the dialog.

Current
A preview of the current color appears above*Current*on the right side of the dialog.

Select
Click the *Select* button to color match to any color on the screen. The cursor changes to an eyedropper. Move the cursor around the screen and the color under *New* changes accordingly. Left-click the mouse when you find the color you want, and the color appears under *New*. Click the *OK* button to accept the new color. The **Colors** dialog closes.

OK or Cancel

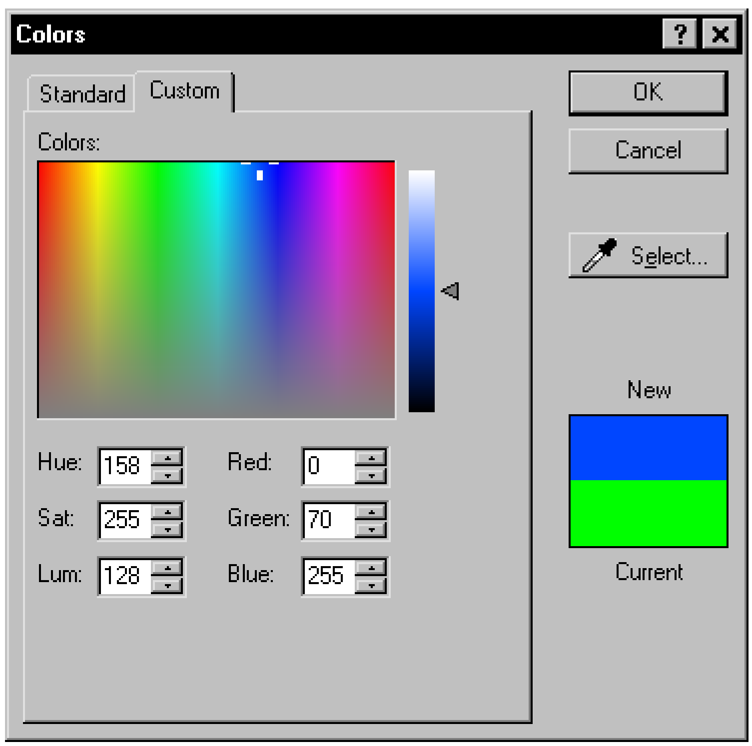
Click *OK* to accept the new color. The **Colors** dialog closes. Click *Cancel* to close the dialog without making any color changes.

Custom Colors - Custom Page

In the **Property Manager**, click the  button to the right of the selected color to open the **Colors** dialog and select a standard color or create new colors. Select a color from the standard color palette on the Standard page. Create new colors by adjusting *Hue, Sat, Lum,* or *Red, Green, Blue* values on the **Custom** page.

Custom Page

Create custom colors on the **Custom** page. New colors are created by adjusting *Hue, Sat, Lum, Red, Green,*and*Blue*values.



*Use the **Colors** dialog **Custom** page to create custom colors.*

Colors

Use the *Colors*group to either select a color from the color spectrum, the color slider, or adjust the values to specify a color.

Left-click anywhere in the color slider to select a color. Drag the slider next to the color spectrum to adjust the new color's intensity. Dragging the slider will change the colors available in the color spectrum.

Left-click anywhere in the color spectrum to choose a new color.

Enter value between zero and 255 in the *Hue*, *Sat*, *Lum*or the*Red*, *Green*, *Blue* boxes. Changing the *Hue, Sat,* and/or *Lum* will automatically adjust the *Red, Green,* and *Blue* values, and vice versa.

Hue, Sat, Lum

The *Hue, Sat,* and *Lum* boxes show the amount of hue, saturation, and luminance used to form the color. The HSL values range from zero to 255. To change the color amounts, enter a new value with the keyboard or click the up and down arrow buttons to adjust the values.

Red, Green, Blue

The *Red, Green,* and *Blue* boxes show the amount of each color used to form the color. The RGB values range from 0 to 255. To change the color amounts, enter a new value with the keyboard or click the up and down arrow buttons to adjust the values.

New

A preview of the new color appears under *New* on the right side of the dialog.

Current

A preview of the current color appears above*Current*on the right side of the dialog.

Select with Eyedropper

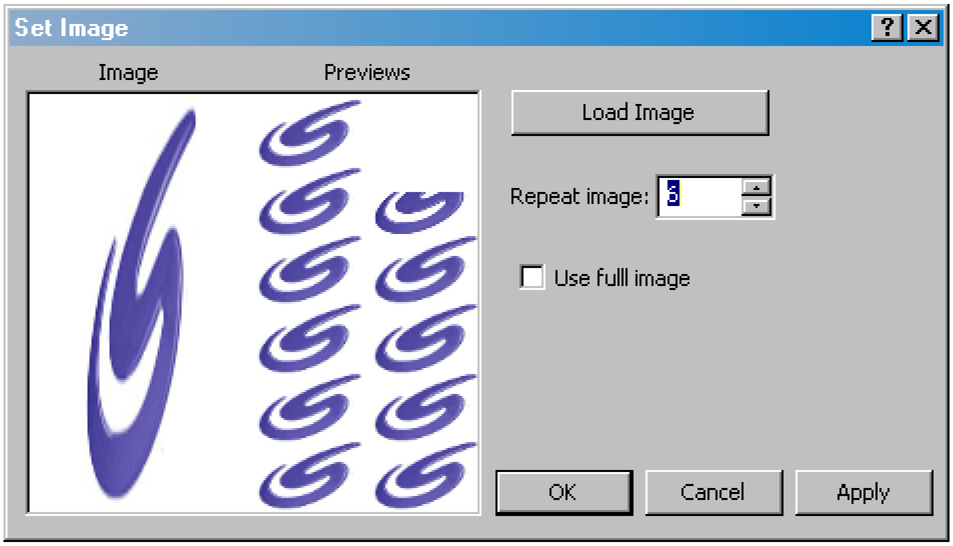
Click the *Select* button to color match to any color on the screen. The cursor changes to an eyedropper. Move the cursor around the screen and the color under *New* changes accordingly. Left-click the mouse when you find the color you want, and the color appears under *New*. Click the *OK* button to accept the new color. The **Colors** dialog closes.

OK or Cancel

Click *OK* to accept the new color. The **Colors** dialog closes. Click *Cancel* to close the dialog without making any color changes.

Set Image Dialog

Use the **Set Image** dialog to specify an image to use when creating a histogram, bar chart, or floating bar chart. To display the **Set Image** dialog, click on the histogram, bar chart, or floating bar chart in the Object Manager or plot window to select it. In the Property Manager, click on the **Plot** tab. Change the *Bar style* to *Image*. Click the*Load*button next to the*Set image*command to open the**Set Image**dialog.



*Use the **Set Image** dialog to specify an image to use when creating a histogram.*

Image

The *Image* section displays the loaded image, as it appears without duplication. The image is adjusted to fit in the box, so it may not appear exactly as the full image appears.

Previews

The *Previews* section displays a preview of the image, repeated the specified number of times. The left side of the preview shows the image repeated the exact number from the*Repeat image*option. The right side of the*Previews*shows a second shorter bar. If the*Use full image*box is checked, the smaller bar shows only full images. If the*Use full image*box is not checked, the smaller bar shows what the bars will look like with the image truncated at the top.

Load Image

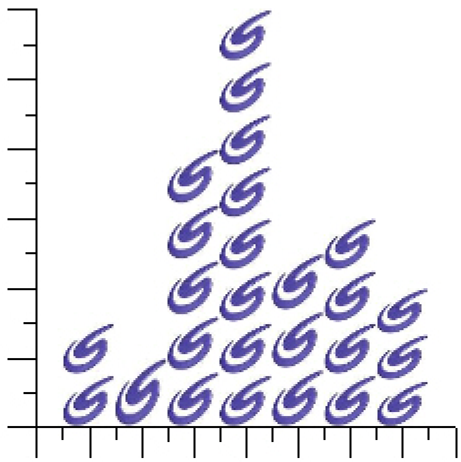
Click the *Load Image* button to open the **Import** dialog. In the **Import**dialog, select an image file and click *Open*. The image is loaded into the**Set Image**dialog.

Repeat Image

Enter a value in the *Repeat image* box to display the image multiple times in each bar in the bar chart, floating bar chart, or histogram. The *Repeat image*value is used for the longest bar. Other bars are scaled using less of the images.

Use Full Image

Check the *Use full image* box to prevent the image from being cut off. If the *Use full image*is checked, each bar can use a slightly different height image to fill the entire bar.



This histogram uses a repeating image with the Use full image*box checked.*

OK, Cancel, Apply

Click *OK* to close the dialog and save your changes. Click *Cancel* to close the dialog without saving your changes. Click*Apply*to see your changes without closing the dialog.

Graph Properties

The selected graph properties are displayed in the Property Manager. You must select the entire graph, not just the plot, to see the graph properties. The properties vary depending on the graph type. The following sections may be available:

Title - set the title text, font, background, and position

Line - set the 2D graph background line properties or 3D graph back wall line properties

Fill - set the 2D graph background fill properties, 3D graph back wall fill properties, and between plot fill properties

3D Settings - set the 3D graph rotation and depth

Graph Properties (pie charts)

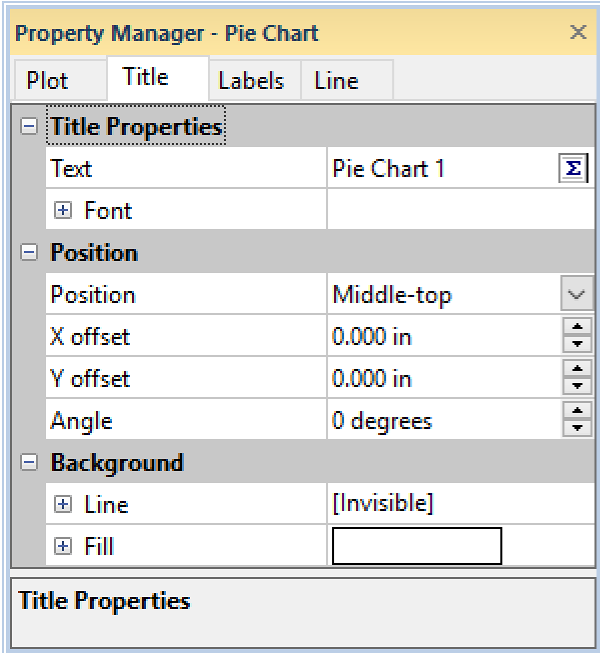
Graph Labels (pie charts)

Graph (radar plots)

Graph (piper plots)

Title Properties

You can add a title to an existing graph through the graph properties. Add a title to a color scale through the color scale properties. Each graph and color scale can only have one title. To view and edit graph title properties, click on the *Graph* object in the Object Manager or plot window to select it. Then, click on the **Title** tab in the Property Manager. To view and edit color scale title properties, click on the *Color Scale* object in the **Object Manager** or plot window to select. Then, click on the **Title** tab in the Property Manager.



*Set the title and title location for a graph on the **Title** page in the **Property Manager**.*

Creating a Graph Title

To add a title to a graph:

1. Select the entire graph.
2. In the Property Manager, click on the **Title** tab.
3. Click the *Editor*button next to *Title*.
4. In the Text Editor, enter the title text and select the text properties.
5. Click *OK* to add the title to the graph.

Creating a Color Scale Title

To add a title to a color scale:

1. Select the color scale.
2. In the Property Manager, click on the **Title** tab.
3. Click the *Editor*button next to *Title*.
4. In the Text Editor, enter the title text and select the text properties.
5. Click *OK* to add the title to the color scale.

See *Color Scale - Contour Maps* or Color Scale - Surface and Vector Plots for instructions on adding a color scale to a graph.

Removing a Graph Title

To remove a graph title:

1. Select the entire graph.
2. In the Property Manager, click on the **Title** tab.
3. Click the *Editor*button next to *Title*.
4. In the Text Editor, delete all of the text.
5. Click *OK* to remove the title from the graph.

Removing a Color Scale Title

To remove a color scale title:

1. Select the color scale.
2. In the Property Manager, click on the **Title** tab.
3. Click the *Editor*button next to *Title*.
4. In the Text Editor, delete all of the text.
5. Click *OK* to remove the title from the color scale.

Moving a Graph Title

To move a graph title:

1. Select the entire graph.
2. In the Property Manager, click on the **Title** tab.
3. Set the *Position*, *X offset*, and *Y offset* values.
4. If the title should be move an additional amount, click the Graph Tools | Plot Tools | Move Labels command.
5. Click on the graph title. Hold down the left mouse button and drag the title to the new location.
6. Press ESC on the keyboard to exit move labels mode.

Moving a Color Scale Title

To move a color scale title:

1. Select the color scale.
2. In the Property Manager, click on the **Title** tab.
3. Set the *Position*, *X offset*, and *Y offset* values.

Title Properties

The *Title Properties* section includes the title text and font properties. You can quickly add a title by typing directly in the *Text* field.

You can make quick font adjustments to the entire title *Text* by editing the font properties in the *Font* section. Alternatively, click the button to edit the title text and text properties in the Text Editor dialog.

Position

Set the title location by choosing one of the eight predefined positions in the *Position* list. The options are *Left-top, Middle-top, Right-top, Left-middle, Right-middle, Left-bottom, Middle-bottom,* and *Right-bottom.* To change the *Position*, click on the existing option. Select the desired option in the list.

Selecting *Left-middle* or *Right-middle* will automatically change the title orientation to vertical, i.e. the *Angle* value is *90* degrees.

X and Y Offset

Title positions can be further refined by entering values into the *X offset* or *Y offset* boxes. Entering a positive value into the offset box moves the label up for the *Y offset* or to the right for the *X offset*. Entering a negative value in the offset box moves the label down for the *Y offset* or to the left for the *X offset*. To enter an offset, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value. The offsets are set in page units.

Angle

You can enter a number into the *Angle* box to rotate the title. Positive values rotate the title in a counter-clockwise direction. The *Angle* is specified in degrees. To enter an angle, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Background Line

Use the *Line* settings in the *Background* section to add a border around the title. Click the next to *Line* to open the line properties section.

Background Fill

Use the *Fill* settings in the *Background* section to add a background fill to the title box. Click the next to *Fill* to open the fill properties section.

Move Labels

The **Graph Tools | Plot Tools | Move Labels** command is used to move individual plot labels, axis tick mark labels, axis titles, graph titles, legend entries, and legend titles. This is useful when the labels or titles overlap each other. End **Move Labels** mode by pressing the ESC key, clicking **Graph Tools | Plot Tools | Move Labels** again, or by clicking the Select Tool.

The plot window cannot be panned with the middle mouse button when **Move Labels** mode is active. If you need to change the view, use the vertical and horizontal scroll bars to change the view. You can also zoom in and out in **Move Labels** mode by rolling the mouse wheel.

The plot window auto-scrolls when a label is dragged into the edge of the plot window. The plot window auto-scrolls in increments while in **Move Labels** mode. If you need to move a label outside of the current view, slowly drag the label to the edge of the plot window. Drag the label back into the plot window, and then drag the label to the edge of the plot window again. Repeat this process until the location where you want the label is visible in the plot window. Finally, drag the label to the desired position.

Return labels, titles, or entries to their default locations by selecting an object and clicking the Reset Positions command.

To Move Plot Labels:

1. Select a single plot.
2. If labels are not already displayed on the plot, check the *Display labels* box on the Labels tab in the Property Manager.
3. Click the **Graph Tools | Plot Tools | Move Labels** command or right-click and select **Move Labels**.
4. Click on a label and drag it to a new location.
5. When you have finished positioning labels press the ESC key.

To Move Graph Titles:

1. Select a graph.
2. If a graph title is not already displayed, click on the Title tab in the Property Manager.
3. Click the *Editor* button next to the *Title* command.
4. In the dialog, type the graph title and click *OK*.
5. Click the **Graph Tools | Plot Tools | Move Labels** command or right-click and select **Move Title**.
6. Click on the graph title and drag it to a new location.

7. When you have finished positioning the graph title, press the ESC key to make the change.

To Move Axis Titles or Axis Labels:

1. Select a single axis.
2. If tick labels are not already displayed on the axis, check the *Show labels* boxes on the Tick Labels tab in the Property Manager.
3. If axis titles are not already displayed on the axis, click the *Editor* button next to the *Title* command on the Axis tab in the **Property Manager**.
4. In the dialog, type the axis title and click OK.
5. Click the **Graph Tools | Plot Tools | Move Labels** command or right-click and select **Move Labels**.
6. Click on a tick label or axis title and drag it to a new location.
7. When you have finished positioning tick labels or the axis title, press the ESC key to make the change.

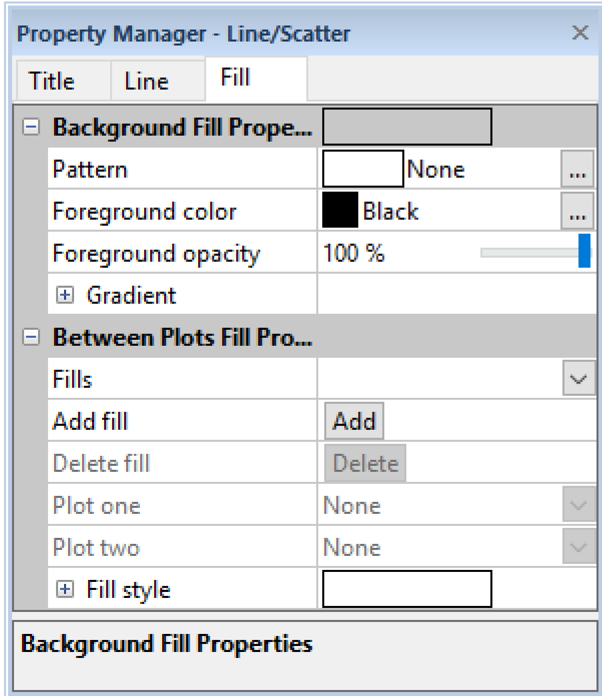
To Move Legend Titles or Entries:

1. Select a single legend.
2. Click the **Graph Tools | Plot Tools | Move Labels** command or right-click and select **Move Labels**.
3. Click on the legend title or entry and drag it to a new location.
4. When you have finished positioning the legend title and entries, press the ESC key to make the change.

Fill Properties - Graph

Graphs can have a fill between two line/scatter plots, step plots, function plots, fit plots, or math plots on 2D graphs. The **Fill** page also includes the fill properties for 2D graph backgrounds and 3D graph back walls.

Click on the *Graph* object in the Object Manager or plot windowto display the **Between Fill** tab in the Property Manager.



*Set the plots to fill between and the between fill style on the **Fill** page in the **Property Manager**.*

Background Fill Properties

The *Background Fill Properties* section includes the fill properties for a 2D graph background.

Back Wall Fill Properties

The *Back Wall Fill Properties* section includes the fill properties for a 3D graph back wall.

Between Plots Fill Properties

The *Between Plots Fill Properties* section includes the commands for adding a fill between two line/scatter, step, function, fit, or summation plots and setting the between fill properties.

Fills

The *Fills* list displays all of the available between plot fills in the currently selected graph. To change which fill is selected, click on the existing name and select the desired name from the list.

Add Fill

Click the *Add* button next to the *Add fill* option to add a new fill to the graph. After clicking *Add*, the *Fills* option changes to the new fill name. By default, fill names are named *Fill 1, Fill 2,* etc.

Delete Fill

Click the *Delete* button next to the *Delete fill* option to delete the currently selected fill. After clicking *Delete*, the *Fills* option automatically changes to the previous fill.

Plots

The *Plot one* and *Plot two* options control which plots are used for the selected fill. To select a plot, click on the existing plot name or *None* next to the *Plot one* or *Plot two* command. Select the desired plot name from the list. Any line/scatter plots, step plots, function plots, fit plots, or summation plots can be selected. Once one plot name is selected, set the other name in the other *Plot one* or *Plot two* list. The order that the plots are selected can make a difference when filling the plots.

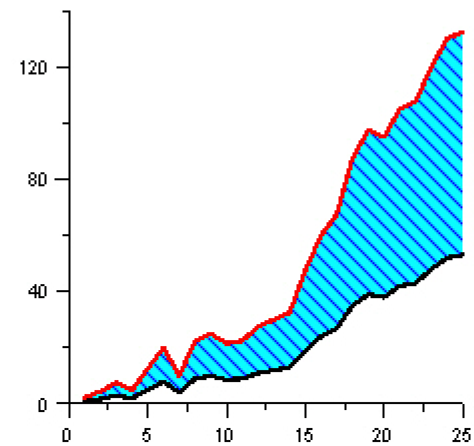
Fill Style

The *Fill style (Plot 1 > Plot 2)* section includes the fill properties, including the pattern, color, and direction, for regions of the graph where Plot 1 is greater than Plot 2. The *Fill style (Plot 2 > Plot 1)* section includes the fill properties for regions where Plot 2 is greater than Plot 1. In graphs where the two plots intersect, the regions can have different fill properties to highlight the different values. However, the *Direction* must be the same in both sections and will automatically update if one is changed.

Creating a Fill Between Multiple Plots

To create a fill between multiple plots:

1. Create a line/scatter plot, step plot, function plot, fit curve, or math plot.
2. Add a second line/scatter plot, step plot, function plot, fit curve, or math plot to the graph.
3. Select the graph in the Object Manager or plot window.
4. Click on the **Fill** tab in the Property Manager.
5. Click the *Add* button next to the *Add fill* option. A fill will be added to the *Fills* list.
6. Click on the first plot you would like to fill between in the *Plot one* list.
7. Click on the second plot you would like to fill between in the *Plot two* list.
8. Click the ⊞ next to *Fill style* to select the between fill properties.



In this example, the lower black line is the first Line/Scatter Plot, and the upper red line is the second Line/Scatter Plot. The Blue region between the two plots was created using Between Fill.

Modifying an Existing Fill Between Multiple Plots

To modify an fill between multiple plots:

1. Select the graph object in the **Object Manager** or plot window.
2. In the **Property Manager**, click on the **Fill** tab.
3. Select the fill you would like to modify in the *Fills* list.
4. If desired, change the plots to fill between listed in the *Plot one* and *Plot two* lists.
5. Change fill properties in the *Fill style* section.

Deleting a Fill Between Multiple Plots

To delete a fill between multiple plots:

1. Select the graph object in the **Object Manager** or plot window.
2. In the **Property Manager**, click on the **Fill** tab.
3. Select the fill you would like to delete in the *Fills* list.
4. Click the *Delete* button next to the *Delete fill* option to delete the selected fill.

Fill Between Plots Tips

- The graph must contain a plot that supports between fills for the *Between Plots Fill Properties* section to be displayed on the **Fill** page.

- If you would like to fill between a plot and an axis, use the Fill Properties section in the plot's properties.

Add to Graph

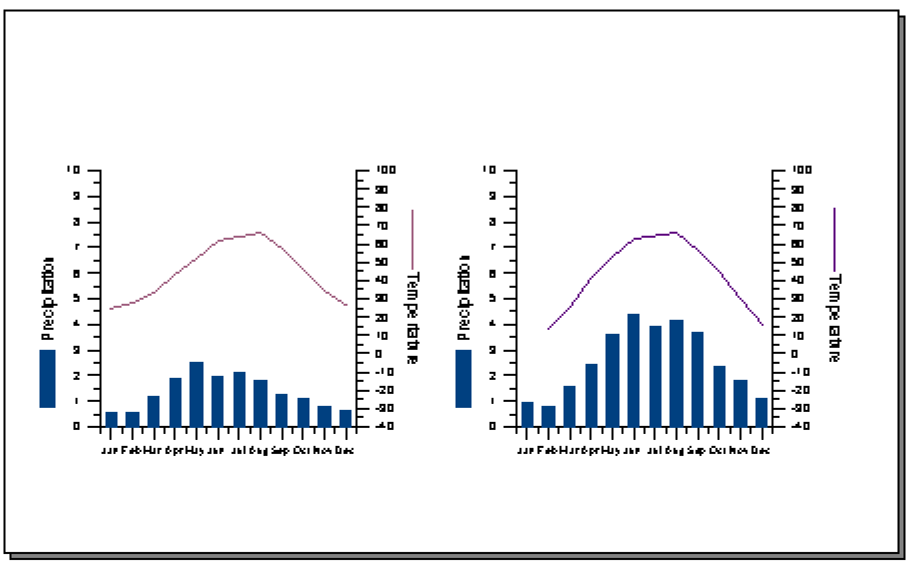
Creating Multiple Graphs on a Page

There are several ways to create more than one graph on a page. The easiest method is to use the mouse, although you can edit the axis properties when creating multiple graphs on a page.

To create multiple graphs on a page:

1. Create the first graph.
2. Select the entire graph.
3. Drag the graph to a new position using the mouse.
4. Create the second graph.
5. Select the entire second graph.
6. Drag the graph to a new position using the mouse.

The graph can also be moved and sized using the axis properties.



To create graphs similar to the one shown above on Legal size paper:

1. Create the first graph.
2. Edit the axis properties. In the left graph, the length and starting positions were set as follows:

- Y Axis 1 (left): *Length* 4.00 inches, *X Position* 1.50 inches, *Y Position* 2.00 inches
- X Axis 1 (bottom): *Length* 4.00 inches, *X Position* 1.50 inches, *Y Position* 2.00 inches
- Y Axis 2 (right): *Length* 4.00 inches, *X Position* 5.50 inches, *Y Position* 2.00 inches

3. Create the second graph.
4. Edit the axis properties. In the right graph, the length and starting positions were set as follows:

- Y Axis 1 (left): *Length* 4.00 inches, *X Position* 8.00 inches, *Y Position* 2.00
- X Axis 1 (bottom): *Length* 4.00 inches, *X Position* 8.00 inches, *Y Position* 2.00 inches
- Y Axis 2 (right): *Length* 4.00 inches, *X Position* 12.00 inches, *Y Position* 2.00 inches

Axis - Add to Graph

Add an axis to an existing graph by clicking one the **Home | Add to Graph | Axis** or **Graph Tools | Add to Graph | Axis** commands. These axes are not tied to the original plot, but they can be used in creating new plots on an existing graph or can be linked manually to an existing axis. To create a duplicate axis automatically linked to another axis on the graph, use the Graph Tools | Add to Graph | Duplicate Axis command instead.

To add a Y axis to a graph:

1. Select any part of the graph (axis, plot, fit, or the entire graph).
2. Select the add axis command by clicking the **Home | Add to Graph | Axis | Y Axis** command.
3. The Position Axis dialog opens. Make any changes and click the *OK* button.
4. The new axis is added to the graph. Set additional axis properties in the Property Manager.

Plot - Add to Graph

Add a plot to an existing graph by using the **Home | Add to Graph | Plot** or **Graph Tools | Add to Graph | Plot** command. When adding a plot with the **Home | Add to Graph | Plot** command, the new plot always uses the default properties. To automatically vary the plot colors when adding new plots, use the *Create* button in the **Plot** page of the Property Manager or use the Graph Wizard.

To add a plot to a graph:

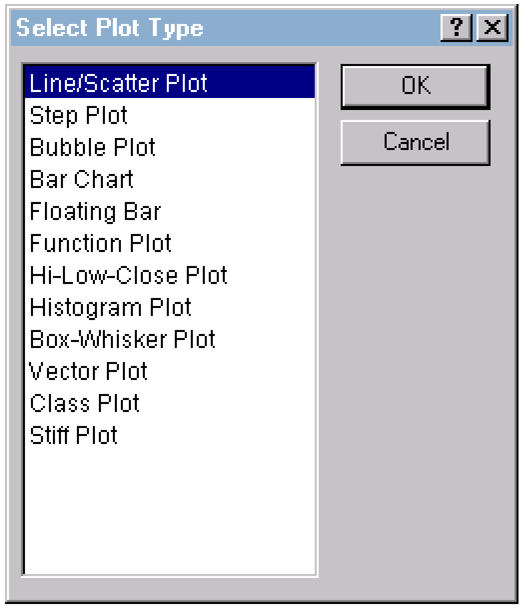
1. Select any part of the graph (axis, plot, fit, or the entire graph).
2. Choose the add plot command by selecting **Home | Add to Graph | Plot** or by right-clicking and choosing **Add Plot**.
3. Select a plot type in the Select Plot Type dialog. The available plot types depend on the plot type in the original graph. For example, if part of a polar plot is selected in step 1, only polar-type plots are available in the **Select Plot Type** dialog.
4. Select the axes to use for the plot in the Choose Axes dialog. You can select existing axes or create new axes in this dialog.
5. Choose a data file in the **Open Worksheet** dialog.
6. Set the properties of the new plot in the Property Manager.

Plot Tips

- The **Plot** command is disabled with pie charts and doughnut plots because pie charts and doughnut plots cannot have any graph types added to them. To add multiple doughnut plots to an existing doughnut plot, click the *Create* button in the **Property Manager** on the **Plot** tab.
- The type of plot that can be added to the graph varies depending on the type of plot in the original graph.
- If your data are organized into one file, you can use the *New plot* option in some plot properties to add new plots to the graph.

Select Plot Type - Add Plot

Use the **Select Plot Type** dialog to select the type of plot to add to an existing graph. Open the **Select Plot Type** dialog by clicking the Home | Add to Graph | Plot command.



Select a plot type to add in the ***Select Plot Type*** *dialog.*

Plot List

Select a plot type from the list of available plots. The list is limited by the original graph type. For example, when adding a plot to a polar graph, polar functions, rose diagrams, wind charts, and other polar plots can be added.

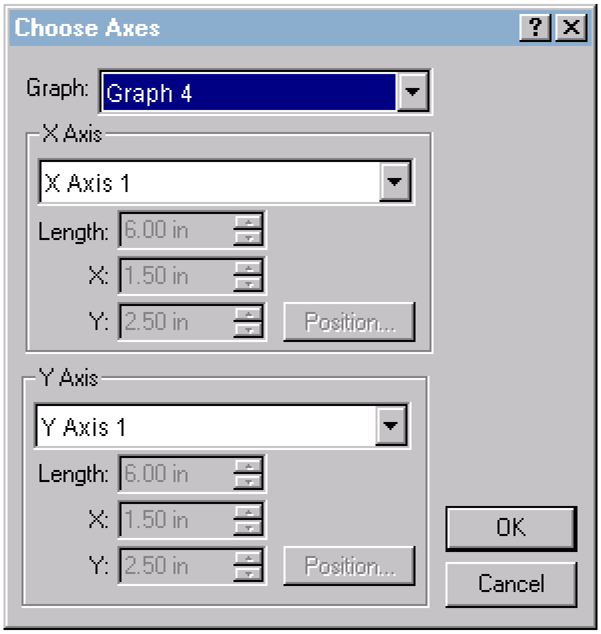
OK or Cancel

Click the *OK* button to close the dialog and save your changes. Click the *Cancel* button to close the dialog without saving your changes.

Choose Axes

You can select axes for the new plot in the **Choose Axes** dialog when adding a new plot to a graph or when pasting a plot as a *Grapher Plot Object*.

The **Choose Axes** dialog is accessible after choosing a plot type in the Select Plot Type dialog.



Select axes for a new plot in the ***Choose Axes*** *dialog.*

Graph

Select a graph from the *Graph* drop-down list.

Axis List

Select an X or Y axis from the lists in the *X Axis* or *Y Axis* groups. Alternatively, you can create a new axis by selecting the *Create new axis* option from the list. If you are working with a 3D XYZ-type plot, you can select a Z axis from the *Z Axis* group or create a new axis.

Create New Axis

If the *Create new axis* option is selected from the axis list, the length, starting position, and positioning options are available:

- Change the axis length by typing a new number into the *Length* box.
- Set the horizontal (X) and vertical (Y) starting positions of the axes by typing new numbers into the *X* and *Y* boxes.
- Click the *Position* button to position the axis relative to other axes or to position the axis according to data values.

Legend

A legend contains information about the lines, fills, and symbols used in a plot or graph. Grapher uses many types of legends.

Type	Description
Legend	displays information for one graph— regardless of how many graphs are on the page— and is attached to a specific graph. The legend indicates the symbols, lines, or fills used by the plots in the graph.
Multi-graph legend	displays information for all the plots in all the graphs on a page and is not attached to any one graph.
Class legend	displays information for the classes in 2D, XYZ, polar, ternary, and piper class plots.
Wind chart legend	displays information about the wind chart speed bins.
Chart slice legend	displays information about pie or doughnut plot slices.
Color table legend	displays information about fill colors used in the color table.
Symbol table legend	displays information about the symbols used in the symbol table.

Class plots and wind charts can also be included in graph legends or multi-graph legends, if necessary, but these higher level legends do not describe the plot classes or wind speed bins.

Creating a New Legend

To create a legend:

1. Select any part of the graph (axis, plot, fit, or the entire graph).
2. Click the **Home | Add to Graph | Legend** command, or right-click and select **Add Legend**.

Displaying a Class, Wind, Color Table, or Symbol Table Legend

Select the *Display legend* option in the Plot page for a class scatter plot, *Display speed bin legend* option in the Plot page for a wind chart, *Show color table legend* on the Fill page, or *Show symbol table legend* on the Symbol page to display the class scatter, wind, color table, or symbol table legend. Clear the check box to hide the legend. You can also hide the legend by clearing the legend's visibility check box in the Object Manager.

Editing an Existing Legend

To change the features of a legend, including the plots displayed in the legend, open the legend properties by selecting the legend and editing the properties in the Property Manager.

The legend properties contain the following sections in the **Property Manager**:

Legend

Entries

Title

Line

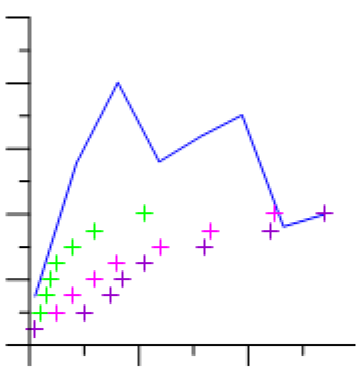
Fill

Detaching Legends

If you need to copy, edit, or add additional information to a legend, such as company information, the legend can be detached from the graph. Legends edited in this manner are no longer attached to the graph, so make sure no additional changes are necessary before proceeding with this process. When detaching a wind or class legend, the wind or class legend is hidden, and the legend is recreated with drawn objects. When detaching other legends, the original legend is removed.

Math Plot

Click the **Graph Tools | Add to Graph | Math Plot** command to create a math plot. A math plot is a plot with Y values calculated from a mathematical function with existing plots. By default, a summation plot is created, where the Y values of selected line/scatter and function plots are added together to get the math plot values. All plots must be on the same graph for creation of a math plot; however, they can use different axes and X values.



Math plots are used to

create new plots from existing columns without modifying the worksheet.

Creating a New Math Plot

To create a 2D math plot:

1. Add one or more line or function plots to an existing graph.
2. Select the graph or any part of the graph.
3. Click the **Graph Tools | Add to Graph | Math Plot** command. The math plot is created in the graph using the default properties.

Editing Math Plot Properties

On initial creation, all line and function plots within the graph are used to create the math plot. To change the features of a math plot— including the plots and equation used to create it— first select the math plot in the plot window or Object Manager and then edit its properties in theProperty Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

Labels

Symbol

Line

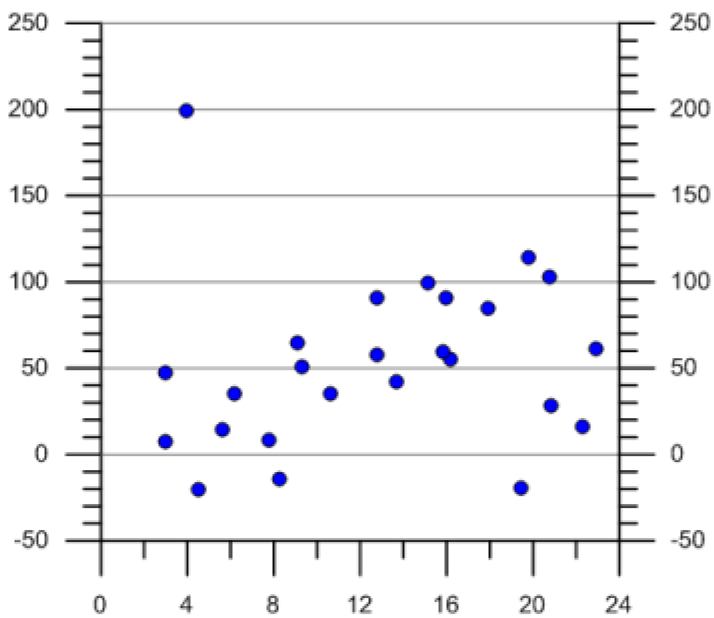
Fill

Duplicate Axis

You can duplicate an existing axis on a graph by selecting the current axis and clicking the **Graph Tools | Add to Graph | Duplicate Axis** command. Alternatively you can right-click on the axis in the Object Manager and select **AddDuplicate Axis**. The duplicate axis has the same axis range and scale as the original axis. The axis is linked to the original, so that when the original axis changes limits, scale, tick mark spacing, or length, the duplicate axis will automatically update. To create an axis that is not tied to an existing graph (scale, range, etc.), create a new axis using of the Home | Add to Graph | Axis commands instead.

To add a duplicate axis to a graph:

1. Click on the controlling axis to select it.
2. Click the **Graph Tools | Add to Graph | Duplicate Axis** command.
3. In the Position Axis dialog,
    1. Set the location for the new axis. For instance, you can select *At the right of.*
    2. Set any other options, such as checking the *Flip tick marks and labels*.
    3. Click *OK*.
4. The axis is added to the graph and automatically has the scale, tick mark spacing, length, and limits linked to the original axis.
5. Click on the duplicate axis to select it and change any desired properties in the **Property Manager**.

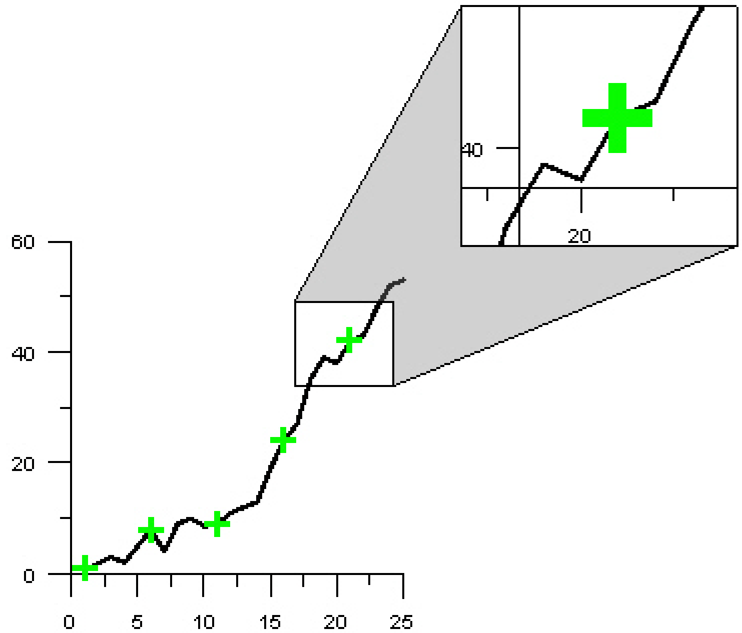


The duplicate axis on the right side of the graph will automatically change when

any properties of the Y axis on the left side of the graph change.

Magnifier

Use the **Graph Tools | Add to Graph | Magnifier** command to add a graph magnifier to an existing 2D graph. Drag a rectangle around the area you want to magnify. The selected area to magnify will become a new *Graph Magnifier* object in the Object Manager with editable properties. The *Graph Magnifier* object consists of the *Area selection box*, *Connector Lines,* and the inset *Zoomed area box*. The *Zoomed area box* is an inset that magnifies what is in the *Area selection box.* The other items other than the graph are not magnified. The *Zoomed area box* also has an additional set of axes that are not present in the *Area selection box*, allowing you to focus on a portion of the graph and still have a reference. The axes in the *Zoomed area box* can be customized. 3D plots and polar plots are not compatible with the magnifier.



This example shows a Magnifier added to a graph. Notice that the axes are added to the magnifier inset for reference. The magnifier lines, fill, and axes can be customized.

Editing an Existing Magnifier

To change the features of a graph magnifier, including the connector section, open the graph magnifier properties by selecting the graph magnifier and editing the properties in the Property Manager.

The graph magnifier properties contain the following sections in the **Property Manager**:

Magnifier

Ticks

Labels

Line

Fill

Legends

Legend

A legend contains information about the lines, fills, and symbols used in a plot or graph. Grapher uses many types of legends.

Type	Description
Legend	displays information for one graph— regardless of how many graphs are on the page— and is attached to a specific graph. The legend indicates the symbols, lines, or fills used by the plots in the graph.
Multi-graph legend	displays information for all the plots in all the graphs on a page and is not attached to any one graph.
Class legend	displays information for the classes in 2D, XYZ, polar, ternary, and piper class plots.
Wind chart legend	displays information about the wind chart speed bins.
Chart slice legend	displays information about pie or doughnut plot slices.
Color table legend	displays information about fill colors used in the color table.
Symbol table legend	displays information about the symbols used in the symbol table.

Class plots and wind charts can also be included in graph legends or multi-graph legends, if necessary, but these higher level legends do not describe the plot classes or wind speed bins.

Creating a New Legend

To create a legend:

1. Select any part of the graph (axis, plot, fit, or the entire graph).
2. Click the **Home | Add to Graph | Legend** command, or right-click and select **Add Legend**.

Displaying a Class, Wind, Color Table, or Symbol Table Legend

Select the *Display legend* option in the Plot page for a class scatter plot, *Display speed bin legend* option in the Plot page for a wind chart, *Show color table legend* on the Fill page, or *Show symbol table legend* on the Symbol page to display the class scatter, wind, color table, or symbol table legend. Clear the check box to hide the legend. You can also hide the legend by clearing the legend's visibility check box in the Object Manager.

Editing an Existing Legend

To change the features of a legend, including the plots displayed in the legend, open the legend properties by selecting the legend and editing the properties in the Property Manager.

The legend properties contain the following sections in the **Property Manager**:

Legend

Entries

Title

Line

Fill

Detaching Legends

If you need to copy, edit, or add additional information to a legend, such as company information, the legend can be detached from the graph. Legends edited in this manner are no longer attached to the graph, so make sure no additional changes are necessary before proceeding with this process. When detaching a wind or class legend, the wind or class legend is hidden, and the legend is recreated with drawn objects. When detaching other legends, the original legend is removed.

Multi-Graph Legend

A multi-graph legend can include information for all graphs on a page and is not attached to any one graph. A Legend contains information for only one graph— regardless of how many graphs are on the page— and it is attached to a specific graph.

Creating Multi-Graph Legends

To create a multi-graph legend:

1. Click **Graph Tools | Add to Graph | Multi-Graph Legend** command.
2. Edit the multi-graph legend properties in the Property Manager.

Editing a Multi-Graph Legend

To change the features of a multi-graph legend, including the plots displayed in the multi-graph legend, open the multi-graph legend properties by selecting the multi-graph legend and editing the properties in the Property Manager.

The multi-graph legend properties contain the following tabs in the **Property Manager**:

Legend

Entries

Title

Line

Fill

Detaching Multi-Graph Legends

If you need to copy, edit, or add additional information to a legend, such as company information, the legend can be detached from the graph. Legends edited in this manner are no longer attached to the graph, so make sure no additional changes are necessary before proceeding with this process.

Detach Legend

Use the **Graph Tools | Plot Tools | Detach Legend** command to unlink a legend from a graph. This command is available for all legends. Detaching a legend breaks the link to the graph and it breaks apart the legend into individual drawing objects. The drawing objects are automatically added to a group. This allows more flexibility in modifying the legend.

Once a legend has been detached, the legend does not automatically reflect any changes in the graph. When the legend has been detached from the graph, it cannot be reattached. Delete the detached legend and then create a new legend to "reattach" the legend.

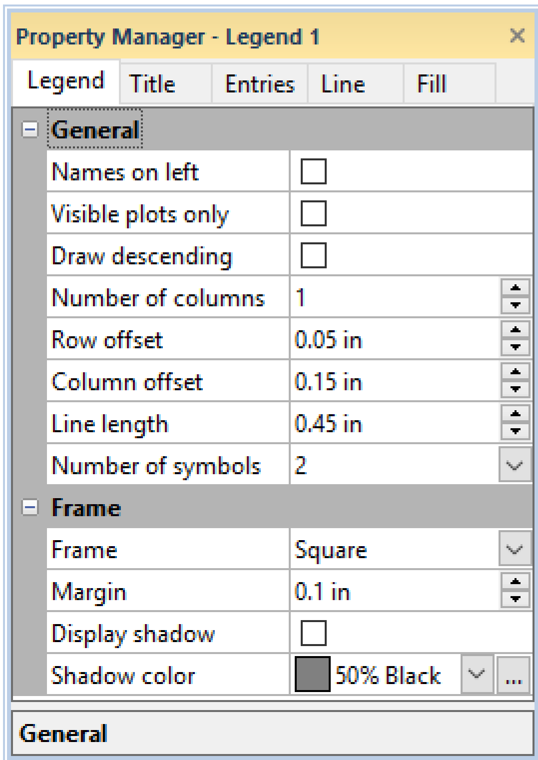
To detach a legend, select the legend and then click the **Graph Tools | Plot Tools | Detach Legend** command.

Polar Wind Chart and Class Scatter Plot Legends

When detaching a wind chart or class scatter plot legend, the legend attached to the graph is not deleted. The *Wind Legend* or *Class Legend* object still exists but the visibility is turned off. The objects creating the legend are broken apart into text, polygons, symbols, and polylines. To return to the linked legend, delete the objects creating the detached legend and check the box next to the *Wind Legend* or *Class Legend* object in the **Object Manager**.

Legend Properties

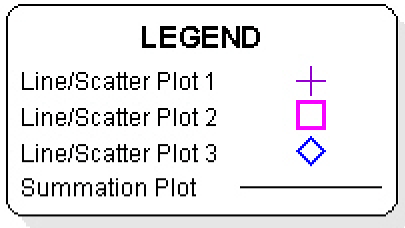
The **Legend** tab controls the legend properties. This section is used to set the legend options including adding plots and entering a legend title. To edit the legend properties, click on a legend to select it. The selected legend properties appear in the Property Manager.



Set the legend properties on the ***Legend*** *tab in the* ***Property Manager****.*

Names on Left

Check the *Names on left* option to display the legend names to the left of the symbols. When this option is not checked, the item name appears to the right of the symbols and lines.



This legend has the Names on left
and a drop shadow of 10% Black.

Visible Plots Only

Check the *Visible plots only* option to only include legend entries for visible plots. Plot visibility is controlled in the Object Manager. The legend automatically updates when a plot visibility is changed.

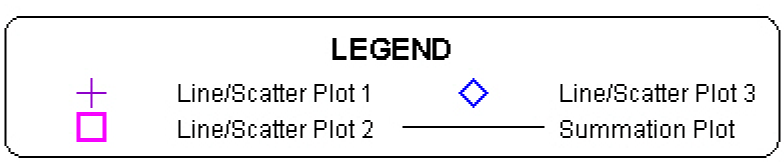
When the *Visible plots only* option is not checked, entries can be removed in the Legend Entries dialog. Entries removed in the **Legend Entries** dialog will not be recreated when the plot visibility changes.

Draw Descending

Check the *Draw descending* option to flip the order of the legend entries. When *Draw descending* is checked, the order of entries in the legend matches the order of the plots in the **Object Manager** when the legend is created. If the plot order is changed after the legend is created, the entry order will not automatically change. The entries can be ordered manually in the Legend Entries dialog. When the *Draw descending* option is not checked, the legend entries are ordered by draw order, i.e. the bottom plot in the **Object Manager** is the first legend entry.

Number of Columns

The *Number of columns* changes how many columns are used to display all the items in the legend. To change the *Number of columns*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value. Select a value between 1 and 100 for the *Number of Columns* to change how many columns are shown in the legend.



This legend has two columns.

Row Offset

Enter a value for *Row offset* to add space between rows of legend items. To change the *Row offset* , highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value. The *Row offset* is measured in page units and is any value between 0 and 1 inches (0 and 2.54 centimeters).

Column Offset

Enter a value for *Column offset* to add space between columns of legend items. To change the *Column offset* , highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value. The *Column offset* is measured in page units and is any value between 0 and 1 inches (0 and 2.54 centimeters).

Line Length

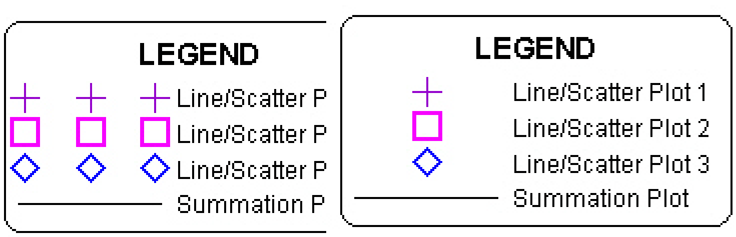
You can set the length of the lines appearing in the legend in the *Line length* field. To change the *Line length*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value. The *Line length* is measured in page units and is any value between 0 and 3 inches (0 and 7.62 centimeters).

Line Fill

Line plots displaying fill will display the fill in the legend automatically. Between fill does not show in the legend.

Number of Symbols

You can set the number of symbols in the legend using the *Number of symbols* list. To change the *Number of symbols*, click on the existing option and select the new option from the list. The list contains options to display 0, 1, 2, or 3 symbols.

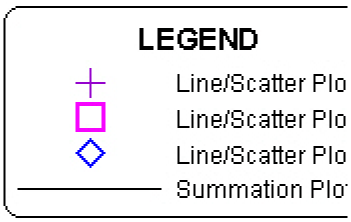


This legend has three symbols.

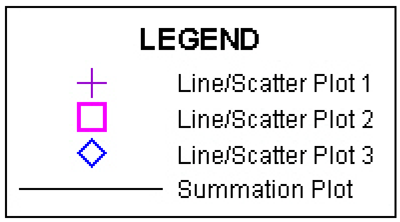
This legend has one symbol.

Frame

The legend *Frame* defines the how the corners on the outside of the legend box are drawn. To change the *Frame*, click on the existing option and select a new option from the list. The *Frame* can be rounded or square. The frame fill properties are located on the Fill page. The frame line properties are located on the Line page.



This legend has rounded corners.



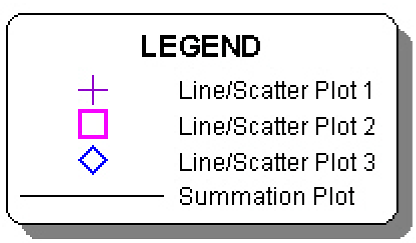
This legend has square corners.

Margin

The amount of space between the text and the legend frame is set through the *Margin* box. To change the *Margin,* highlight the existing option and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value. The *Margin*is measured in page units and can be any number between 0 and 1 inches (0 and 2.54 centimeters).

Display Shadow

Check the box next to *Display shadow* to add a shadow effect behind the legend.



This legend has a drop shadow with a shadow color of 50% Black*.*

Shadow Color

Click the color display next to *Shadow color* to open the color palette. Select a color for the display shadow and the legend will automatically update.

Entries

The *Entries* section specifies which classes, bins, or plots are included in the legend. For chart slice legends, the *Entries* section controls the entry labels.

Legend and Class Legend Entries

You can set the multi-graph legend or legend plot names, change the symbol sizes or font, and add or remove plots from a legend by clicking the *Edit* button next to *Entries*. You can set the class legend class names, symbol sizes, and entry font by clicking the *Edit* button next to *Entries*. These options are changed in the Legend Entries dialog.

Wind Legend Entries

A wind legend entry is displayed for each speed bin. A bin color sample is displayed next to the bin lower and upper limits. The *Entries* section includes the font properties for the entries.

Chart Slice Entries

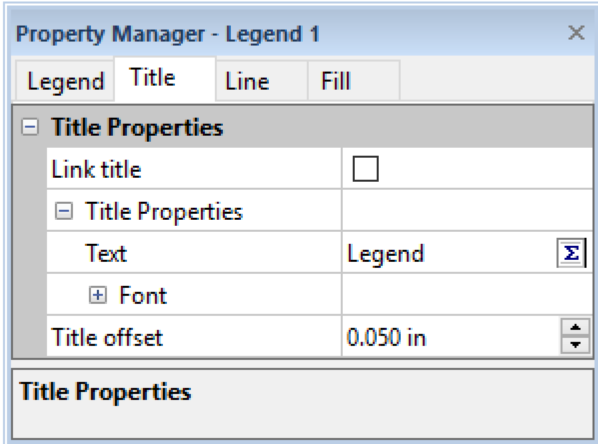
A chart slice legend entry is displayed for each pie or doughnut slice. A slice color sample is displayed next to the user-specified label. The entry label can be the *From worksheet*, *Data value*, or *Percentage* label from the pie or doughnut plot Labels page.

Default Legend Settings

Items such as default graph titles, line styles, and fill patterns can be set by creating a template graph. All legend settings including the symbol size and preference for plot-sized symbols can be saved as a preference with the File | Defaults command and selection of *Legend* on the left side of the dialog.

Title Properties

You can add a title to a legend in the **Title** page of the Property Manager. Each legend can only have one title. To view and edit legend title properties, click on the *Legend* object in the Object Manager or plot window to select it. Then, click on the **Title** tab in the Property Manager.



Set the title and title location for a legend on the ***Title*** *page in the* ***Property Manager****.*

Link Title

Check the box next to *Link Title* to link the legend title to the graph title. The title appears above the legend and matches the title of the selected graph in the Object Manager. As long as the box remains checked, the name of the legend item automatically updates whenever the graph title is changed. This option is not available for a multi-graph legend.

Title Properties

The *Title Properties* section includes the title text and font properties. You can quickly add a title by typing directly in the *Text* field. You can make quick font adjustments to the entire title *Text* by editing the font properties in the *Font* section.

Alternatively, click the button to edit the title text and text properties in the Text Editor dialog.

Title Offset

Enter a value for *Title offset* to add space between the legend title text and the legend items. To change the *Title offset*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value. The *Title offset* is measured in page units and is any value between 0 and 1 inches (0 and 2.54 centimeters).

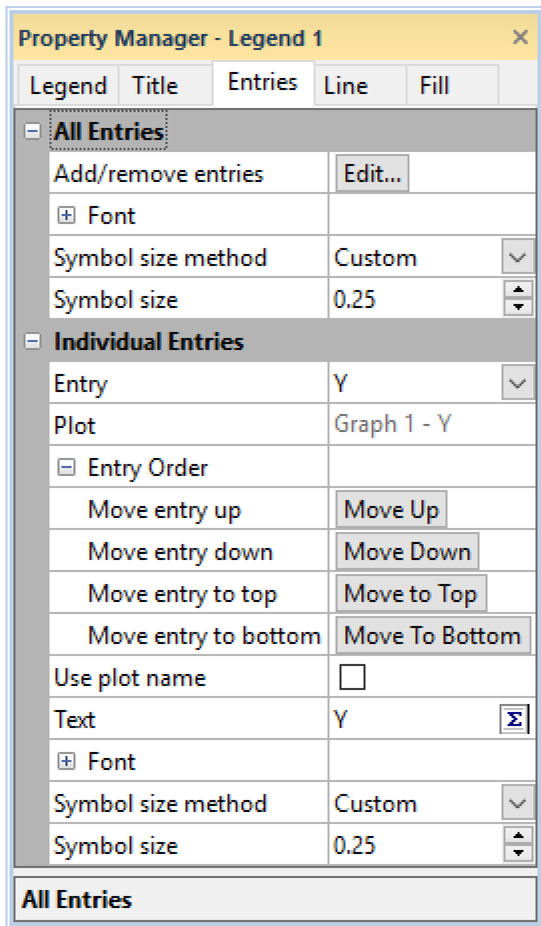
Moving the Legend Title

The legend title and entries can be moved with the **Graph Tools | Plot Tools | Move Labels** command.

1. Select the legend in the plot window or **Object Manager**.
2. Click **Graph Tools | Plot Tools | Move Labels**.
3. Click and drag the legend title and/or entries to the desired locations.
4. Press ESC to end **Move Labels** mode.

Legend Entries

Set the legend entry plot names, change the legend entry symbol sizes, and add or remove plot entries from a legend in the Entries page in the Property Manager.



*Set the properties for all entries or for each entry in the **Entries** page.*

All Entries

Properties in the *All Entries* section apply to all legend entries. Wind legends and chart slice legends have only an *Entries* section for all entries.

Add/Remove Entries

Click *Edit* in the *Add/remove entries* field to select which entries should be displayed in the legend. The plots are selected in the Select Plots dialog.

Label

For pie chart legends, set the *Label* to *None*, *From worksheet*, *Data value*, or *Percentage* for the chart slice legend labels.

- The *None* option hides the label.
- The *From worksheet* option uses the *Labels column*.
- The *Data value*displays the value in the*Data column*.
- The*Percentage*calculates the percentage this slice is of the entire pie chart and displays the percentage value.

Font

Click the ⊞ next to *Font* to set the legend entry font properties for all legend types.

Format

Click the ⊞ next to *Format* to set the chart slice legend entry label format properties.

Background

Click the ⊞ next to *Background* to set the chart slice legend entry background properties. The *Background* is the area behind each entry.

Symbol Size Method

The *Symbol size method* changes the size of the symbols in the legend.

- *Fixed* symbols are fixed at a program default size.
- *Plot size* displays the graphed symbol size. If the graphed symbol size changes, the legend symbol size changes as long as the **Graphs | Legend | Detach** command is not used.
- *Custom* displays custom symbol sizes in the legend. When the *Symbol size method* is set to *Custom*, specify the symbol size in the *Symbol size* field.

Individual Entries

The properties in the *Individual Entries* section apply only to the selected entry. Each entry can have different properties. Wind and chart slice legends do not have an individual entries section.

Entry

Select the entry to edit in the *Entry* list.

Plot

The *Plot* is a read-only value that indicates which graph and plot entry is being edited.

Entry Order

Expand the *Entry Order* section to rearrange the entries in the legend. Entries can be moved by clicking *Move Up, Move Down, Move to Top,* and *Move to Bottom*.

Use Plot Name

When the *Use plot name* option is selected, the legend entry is linked to the plot name in the Object Manager. When the plot name is changed, the legend entry updates automatically. Clear the *Use plot name* option to change the entry name.

Reset to Entry Defaults

When the *Reset to entry defaults* option is selected, the legend entry uses the default name and font. By default, class legend entry names are linked to the class name. Clear the *Reset to entry defaults* option to rename the legend entry and/or change the entry font.

Text

Specify the text for the legend entry in the *Text* field when the *Use plot name* or *Reset to entry defaults* option is not selected.

Font

Set the font properties for the selected entry.

Symbol Size Method

Set the symbol size for the selected entry, see *All Entries* section above.

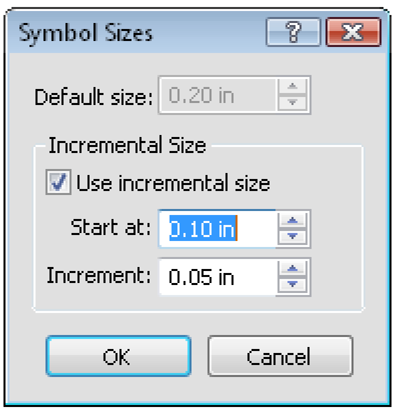
Moving the Legend Entries

The legend title and entries can be moved with the **Graph Tools | Plot Tools | Move Labels** command.

1. Select the legend in the plot window or **Object Manager**.
2. Click **Graph Tools | Plot Tools | Move Labels**.
3. Click and drag the legend title and/or entries to the desired locations.
4. Press ESC to end **Move Labels** mode.

Symbol Sizes Dialog

The **Symbol Sizes** dialog allows the class scatter plot symbol size to be changed for all symbols at once. The dialog also allows for symbol size to be set to an increment, changing the size of the symbols for all classes by a set value. To open the **Symbol Sizes** dialog, click the *Symbol sizes* button in the Edit Classes dialog.



Set the size for all classes using an increment value.

Default Size

When *Use incremental size* is unchecked, the *Default size* option is available. This sets the size of all class symbols to the size specified. To change theDefault *size*, highlight the existing value and type a new number in the box. Alternatively, click the  to increase or decrease the size of the symbol. Symbol sizes are between 0.0 and 4.0 inches (0.0 and 10.16 centimeters) and are shown in page units. All class symbols are set to the specified size.

Incremental Size

When *Use incremental size* is checked, symbol sizes vary. The first class has a symbol with the size set in the *Start at* box. The next class has a symbol size set by adding the *Increment* value to the *Start at* value. So, if the *Start at* is set to 0.10 inches and the *Increment* is set to 0.05 inches, the second class would have a symbol size of 0.15 inches, the third class would have a symbol size of 0.20 inches, and so on.

To change the *Start at* value, highlight the existing value and type a new value. Alternatively, click the buttons to increase or decrease the starting symbol size. Values range from 0.01 to 1.0 inches.

To change the *Increment* value, highlight the existing value and type a new value. Alternatively, click the buttons to increase or decrease the incremental symbol size. Values range from 0.01 to 1.0 inches.

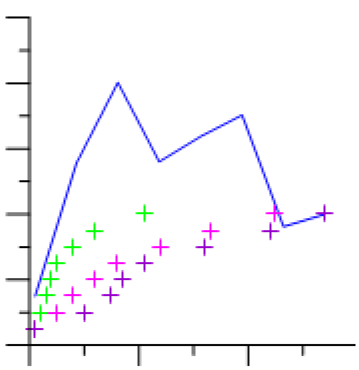
OK or Cancel

Click *OK* to return to the **Edit Classes** dialog, making the change to the symbol sizes. Click *Cancel* to return to the **Edit Classes** dialog without making any changes.

Summation Plots

Math Plot

Click the **Graph Tools | Add to Graph | Math Plot** command to create a math plot. A math plot is a plot with Y values calculated from a mathematical function with existing plots. By default, a summation plot is created, where the Y values of selected line/scatter and function plots are added together to get the math plot values. All plots must be on the same graph for creation of a math plot; however, they can use different axes and X values.



Math plots are used to create new plots from existing columns without modifying the worksheet.

Creating a New Math Plot

To create a 2D math plot:

1. Add one or more line or function plots to an existing graph.
2. Select the graph or any part of the graph.
3. Click the **Graph Tools | Add to Graph | Math Plot** command. The math plot is created in the graph using the default properties.

Editing Math Plot Properties

On initial creation, all line and function plots within the graph are used to create the math plot. To change the features of a math plot— including the plots and equation used to create it— first select the math plot in the plot window or Object Manager and then edit its properties in theProperty Manager.

Click the following tabs in the **Property Manager** to change different properties:

Plot

Data Limits

Labels

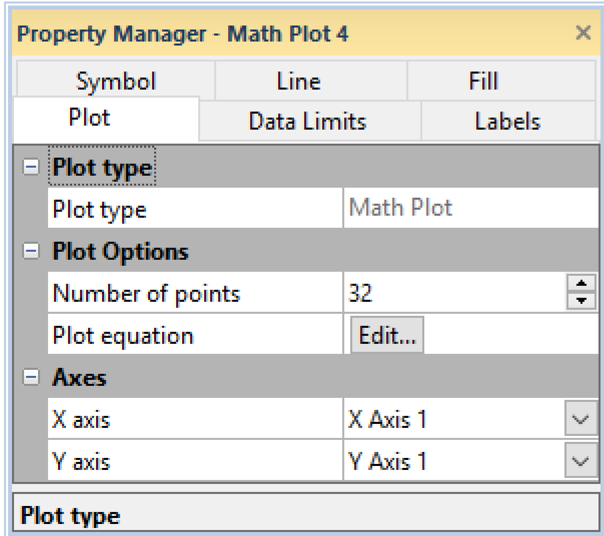
Symbol

Line

Fill

Plot Properties - Math Plot

The math plot properties **Plot** page contains the options to change the axes, set the number of points, and control the equation used to create the math plot. To view and edit math plot properties, click on the math plot in the plot window or Object Manager to select it. Then, click on the **Plot** tab in the Property Manager.



*Set the math plot properties in the **Property Manager** on the **Plot** tab.*

Plot Type

The *Plot type* property displays the type of plot.

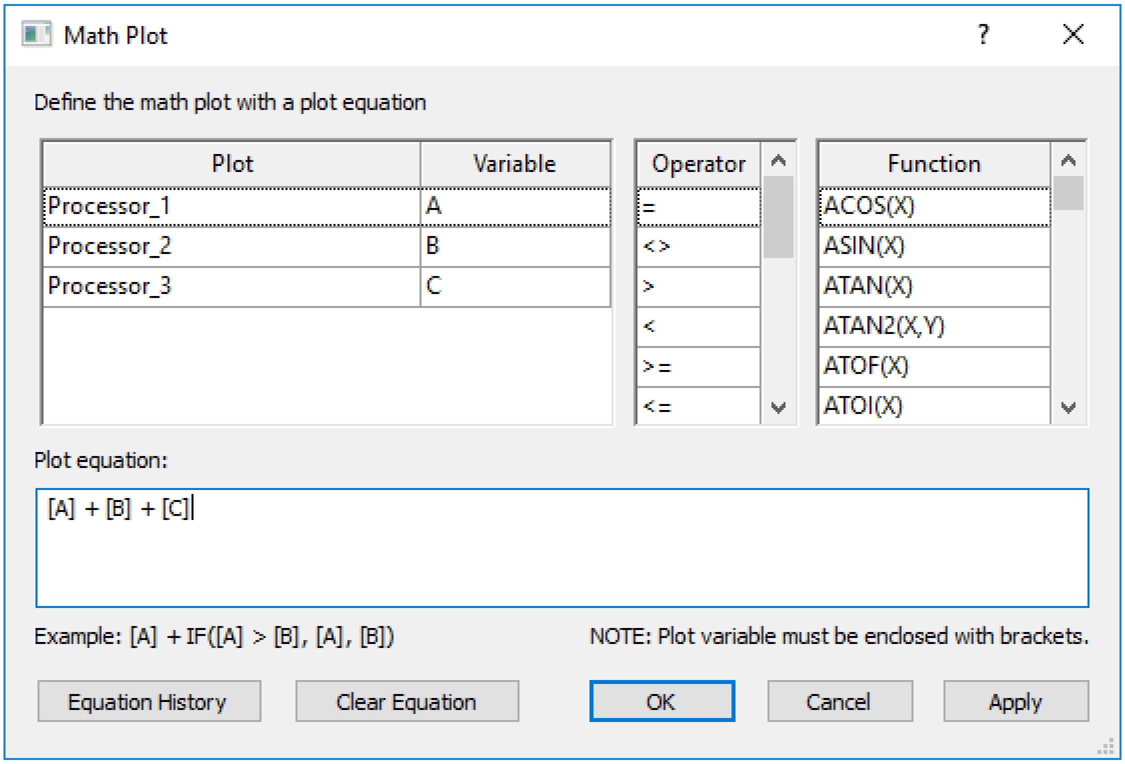
Number of Points

The *Number of points* option sets the number of times the math plot value is calculated. The math plot evaluates the *Plot equation* at equally spaced intervals between the X minimum and X maximum. The interval between the points is set by the *Number of points* value. If the X values do not coincide with the source data, then the Y values are determined by linear interpolation between the two nearest data points. Therefore, if the X values are not shared among all component plots OR if the X values are not equally spaced, consider increasing the *Number of points* to 1000.

By default, the *Number of points* is equal to the maximum number of data points in the component plots. The value must be >= 2 and <= 2.14748e+009. The larger the value, the longer it will take to generate the math plot and update changes on the plot.

Plot Equation

The *Plot equation* property includes a list of all of the plots in the graph. Click the *Edit* button next to *Plot equation* to open the **Math Plot** dialog. In the **Math Plot** dialog, specify the equation for creating the math plot, including which plots are included in the math plot.



Set the plot equation for the math plot in the **Math Plot** dialog.

Math Plot Equation

Define the math plot equation by typing the equation directly in the *Plot equation* field. You can also create the plot equation by double-clicking items in the *Plot*, *Variable*, *Operator*, and *Function* lists. The *Plot equation* can include plot variables in square brackets, [], operators, and mathematical functions.

Plot variables can be specified by the plot name, e.g. [Processor_1], or by the variable, e.g. [A] in the **Math Plot** dialog. If the order of the plots is changed in the Object Manager, the plot variables automatically update to keep the math plot results the same.

Click *Clear Equation* to clear the *Plot equation* field.

Equation History

Click *Equation History* to display a list of previously used equations in the **Expression History** dialog. Double-click or select an equation and click *OK* to reuse a *Plot equation*.

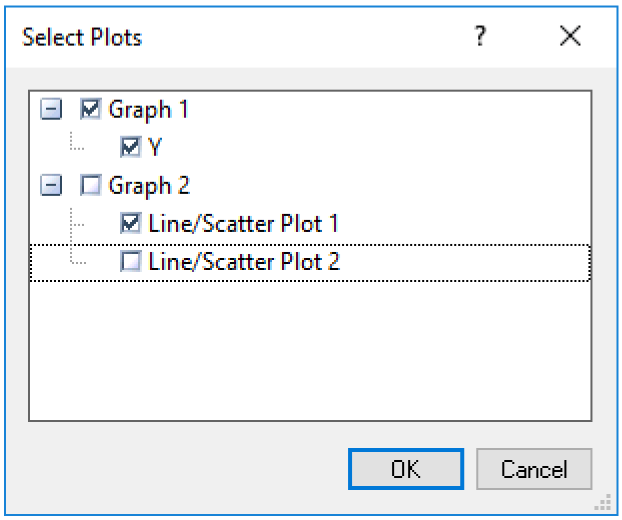
Change Axes

Click on the axis name next to the *X axis* or *Y axis* fields to change the axes used for the plot. Select another axis name from the list. Alternatively, click *Select plots/axis* to change the axis used by several plots on a graph at once.

See the Axis - Add to Graph page for information about how to add a new axis to the graph. Once the new axis is added to the graph, it will be available in the *X axis*, *Y axis*, or *Z axis* lists.

Select Plots

The **Select Plots** dialog is used to change the plots included in a legend or multi-graph legend. The **Select Plots** dialog is accessed via the **Property Manager** Entries page.



*Use the **Select Plots** dialog to add or remove entries in a legend.*

To open the **Select Plots** dialog:

1. Add a legend to the graph or multi-graph legend to the plot window.
2. Select the *Legend* object in the**Object Manager**.
3. Click the **Legend** tab in the **Property Manager**.
4. Next to *Add/remove entries*, click the *Edit* button. The **Select Plots** dialog opens and lists the names of all plots in the graph or plot that can be used in the legend.

Plots

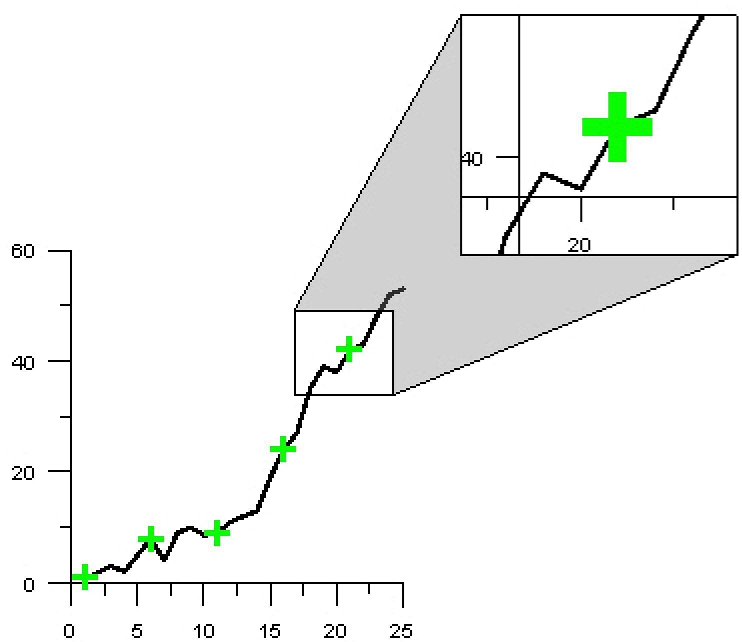
Select or clear the box to the left of each plot name in the **Select Plots** dialog to control the visibility of each individual plot. This turns the display of the entry on or off. This is similar to selecting or clearing the visibility box in the **Object Manager**.

In multi-graph legends, select or clear the box to the left of each graph name to change the visibility for all plot entries at once.

Magnifier

Magnifier

Use the **Graph Tools | Add to Graph | Magnifier** command to add a graph magnifier to an existing 2D graph. Drag a rectangle around the area you want to magnify. The selected area to magnify will become a new *Graph Magnifier* object in the Object Manager with editable properties. The *Graph Magnifier* object consists of the *Area selection box*, *Connector Lines,* and the inset *Zoomed area box*. The *Zoomed area box* is an inset that magnifies what is in the *Area selection box.* The other items other than the graph are not magnified. The *Zoomed area box* also has an additional set of axes that are not present in the *Area selection box*, allowing you to focus on a portion of the graph and still have a reference. The axes in the *Zoomed area box* can be customized. 3D plots and polar plots are not compatible with the magnifier.



This example shows a Magnifier added to a graph. Notice that the axes are added to the magnifier inset for reference. The magnifier lines, fill, and axes can be customized.

Editing an Existing Magnifier

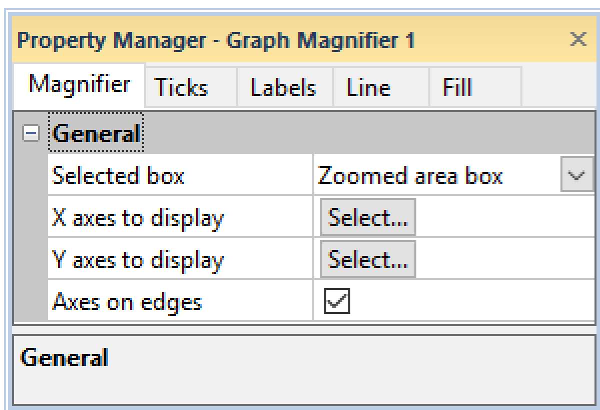
To change the features of a graph magnifier, including the connector section, open the graph magnifier properties by selecting the graph magnifier and editing the properties in the Property Manager.

The graph magnifier properties contain the following sections in the **Property Manager**:

Magnifier
Ticks
Labels
Line
Fill

Magnifier Page

The **Magnifier** page controls the box selection and the axes displayed in the *Zoomed area box.*

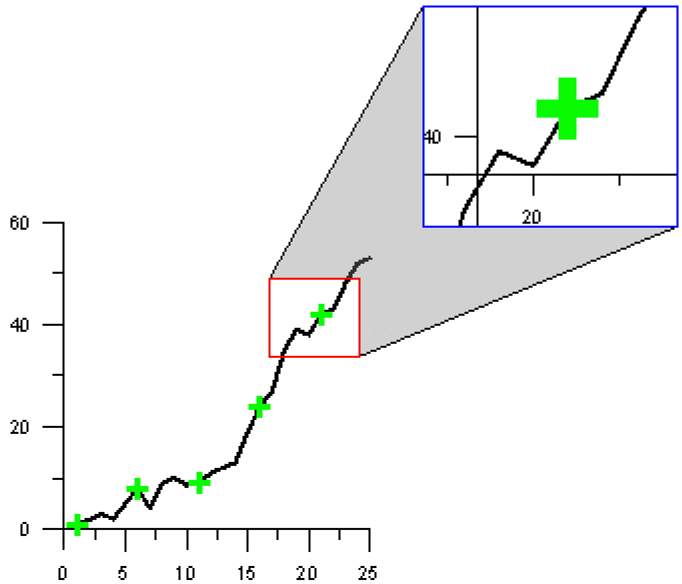


*The **Magnifier** tab in the **Property Manager** controls the graph magnifier axis settings.*

Selected Box

The *Selected box* section controls which box of the magnifier is selected. To change the *Selected box*, click on the current option and select the desired option from the list. Select *Area selection box* or *Zoomed area box* from the *Selected box* list to select what box is currently selected. The selected box will be seen in the plot window with six green selection handles around the entire box. Change the *Selected box* to move either box around in the plot window.

Another method to switch which box is selected is to right-click on the magnifier and choose **Switch box**.



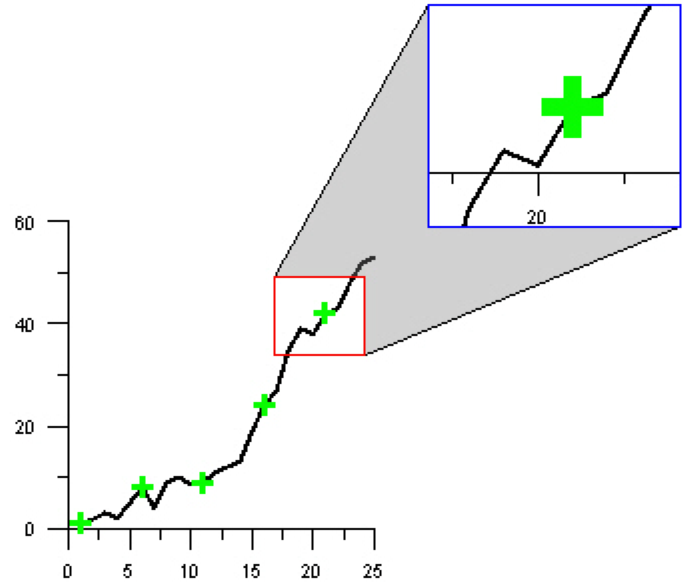
This example shows the Area selection box *in red and the* Zoomed area box *in blue.*

X Axes to Display

Click the *Select* button to open the **Select Axes** dialog.In the dialog, select the box next to any of the axes to display the axis in the *Zoomed area box*. A check mark indicates the axis will be displayed in the *Zoomed area box.* Click *OK* to close the dialog and return to the **Property Manager**.

Y Axes to Display

Click the *Select* button to open the **Select Axes** dialog. In the dialog, select the box next to any of the axes to display the axis in the *Zoomed area box*. A check mark indicates the axis will be displayed in the *Zoomed area box.* Click *OK* to close the dialog and return to the **Property Manager**.



This example shows only the X axis being displayed in the Zoomed area box.

Axes on Edges

The *Axes on edges* option forces the axes to the edge of the *Zoomed area box*. The axis is forced to the edge of the *Area selection box* nearest the axis. For example, an X axis at the top of the graph will be forced to the top edge of the *Zoomed area box*, while an X axis at the bottom of the graph will be forced to the bottom of the *Zoomed area box*.

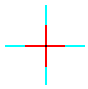
The *Axes on edges* option limits the location of tick marks and tick labels. When *Axes on edges* is selected, tick marks and labels must be plotted inside the axes in the *Zoomed area box*. Clear the *Axes on edges* option to enable the *Show ticks on top/right* and *Show ticks on bottom/left* options on the Tick Marks page and the *Labels on side* option on the Tick Labels page.

Digitizing

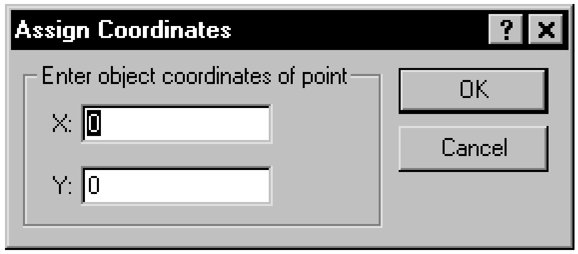
Assign Coordinates

The **Insert | Image Editing | Assign Coordinates** command assigns linear coordinates to an imported file. To create the coordinate system, you must be able to identify two known coordinate values on the graphic. After assigning coordinates to the graphic, you can use Insert | Image Editing | Digitize to obtain data from the graphic.

To assign coordinates:

1. Import the file by pasting or by using File | Import. If you are pasting pictures (.EMF or .WMF), do not break apart the file.
2. Select the imported graphic.
3. Select the **Insert | Image Editing | Assign Coordinates** command.
4. A dialog appears providing a set of instructions, *After closing this message box, click on a point with known coordinates in the object.* Click the *OK* button in the dialog and the pointer changes into a  with the cyan lines extending to the edges of the plot window.
5. Move the cross hair over a known point. Good points include axis tick marks, particularly the axis maximums, and symbols with known coordinates.
6. Left-click on the known point to open the **Assign Coordinates** dialog.
7. Enter the known X and Y coordinates into the dialog.
8. Click the *OK* button to close the **Assign Coordinates** dialog.
9. A dialog appears providing the next set of instructions, *After closing this message box, click on a point with different x,y coordinates from the previous point*. Click the *OK* button in the message box and the pointer changes into a cross hair.
10. Move the cross hair over a different point where data values are known. The second point should not fall in a straight horizontal or vertical line to the first point. If you do select a point along a horizontal or vertical line to the first point, you will have to repeat steps 9 and 13 until a non-collinear point is selected.
11. Left-click on the known point to open the **Assign Coordinates** dialog.
12. Enter the known X and Y coordinates into the dialog.
13. Click the *OK* button to close the **Assign Coordinates** dialog.

The coordinate system is now assigned to the graphic. If you decide to reassign the coordinates, select the graphic, and then select the **Graph | Digitizing | Reassign Coordinates** command to repeat the above process.



Enter coordinates of a known point in the Assign Coordinates dialog.

Digitize

The **Graph Tools | Digitize | Digitize** command activates the display of graph coordinates on the status bar and allows you to write graph coordinates to a data file. As you move the pointer, the X, Y (and Z if applicable) coordinates for the current mouse position are shown in the status bar. Click the left mouse button and the report window is displayed. The coordinates for the clicked point are written to the report window. Each time the mouse is clicked, a small, temporary red symbol is drawn and the coordinates for the current mouse position are written to the report window. In this way, you can digitize information from graphs and easily create data files from the digitized information.

Select a plot to activate the command. If any other objects are selected, e.g., entire graphs, axes, titles, drawing objects, the **Digitize** command is not available. Digitizing is available only for 2D graph types.

You can set the digitize properties, e.g., number of decimal places and symbol properties, through File | Options.

To use the **Digitize** command:

1. Create a graph or calibrate a bitmap or picture with coordinates.
2. Select a bitmap, picture, or plot, such as a line/scatter plot.
3. Choose the **Graph Tools | Digitize | Digitize** command and the cursor becomes a cross hair cursor.
4. As you move the cross hair cursor within the window, the graph coordinates for the position are displayed in the status bar.
5. Click the left mouse button to write the current coordinates to the report window. You can add several points using this process.
6. When you are finished using the **Digitize** command, click on any tool button, select another command, or press the ESC key.
7. Save the data as a text file .TXT or a rich text file .RTF.

Digitize Tip

Before selecting the **Digitize** command, zoom in on the graph for greater precision in digitizing.

Changing the Digitizing Symbol

To change the digitizing symbol:

1. Click the **File | Options** command.
2. In the **Options** dialog, click on *Digitize Format* on the left side of the dialog.
3. On the right side of the dialog, click the ⊞ next to *Symbol*.
4. Select the *Symbol* by clicking on the existing symbol and selecting the desired symbol from the list.
5. Change the symbol size, color, or other symbol properties if desired.
6. Click *OK* to return to the plot window.
7. Click on the plot and click the **Graph Tools | Digitize | Digitize** command.
8. Click on the screen and the new symbol will be displayed.

Digitize Fixed

Use the **Graph Tools | Digitize | Digitize Fixed** command to digitize only those points that are directly on a line/scatter, function, or step plot. When using this command, the pointer is "locked" to the plot. Points that are not on the plot cannot be digitized with this command. Use Graph Tools | Digitize | Digitize if you wish to digitize other points or if you need to digitize from a bitmap graph.

Select a plot to activate the command. If any other objects are selected, e.g., entire graphs, axes, titles, drawing objects, the **Digitize Fixed** command is not available. Digitizing is available only for 2D graph types. Additionally the **Digitize Fixed** command is not available if the plot contains no data points.

You can set the default digitize properties, e.g., number of decimal places or symbol properties, with the File | Options command.

To use the **Digitize Fixed** command:

1. Create a graph.
2. Select a line/scatter, function, or step plot.
3. Choose the **Graph Tools | Digitize | Digitize Fixed** command

and the cursor becomes a cross hair cursor.

4. As you move the cross hair cursor within the window, the graph coordinates for the position along the plot are displayed in the status bar.
5. Click the left mouse button to write the current coordinates to the report window. Each time the mouse is clicked, a small, temporary red symbol is drawn and the coordinates for the current mouse position are written to the report window. You can add several points using this process. Any point on the plot can be digitized.
6. When you are finished using the **Digitize Fixed** command, press the ESC key.
7. Save the data as a text file .TXT or a rich text file .RTF.

To change the digitizing symbol:

1. Click the **File | Options** command.
2. In the **Options** dialog, click on *Digitize Format* on the left side of the dialog.
3. On the right side of the dialog, click the ⊞ next to *Symbol*.
4. Select the *Symbol* by clicking on the existing symbol and selecting the desired symbol from the list.
5. Change the symbol size, color, or other symbol properties if desired.
6. Click *OK* to return to the plot window.
7. Click on the plot and click the **Graph Tools | Digitize | Digitize** command.
8. Click on the screen and the new symbol will be displayed.

Convert Graph or Plot

Use the **Graph Tools | Convert | Plot Type** command to change from one plot type to another. Use theGraph Tools | Convert | Graph to 2D/3D- command to change from onegraph type to another.

To change from one plot type to another, e.g. line plot to bar chart:

1. Select a single plot, i.e., "Line/Scatter Plot 1" in the **Object Manager**.
2. Click the **Graph Tools | Convert | Plot Type** command and choose **Line**; **Line/Scatter**; **Scatter**; **Step**; **Bar, horizontal**; or **Bar, vertical**.

Some plot conversion tips include the following:

- If **Graph Tools | Convert | Plot Type** is disabled, an object other than a single plot is selected or you have selected a plot type that is not supported with this command.
- The original plot must be a line/scatter plot, a ribbon/wall plot, a step plot (2D or 3D XY), or a bar chart (2D or 3D XY).
- You can change between line plots, line/scatter plots, scatter plots, step plots, horizontal bar charts, and vertical bar charts.
- If you cannot change from one plot type to the desired plot type, create the new plot type from the Graph Wizard or **Home | New Graph** commands.

To convert a 2D graph to a 3D graph (or vice versa):

1. Select a graph, i.e., "Graph 1" in the **Object Manager**.
2. Click the **Graph Tools | Convert | Graph to 2D/3D** command. Any objects in the graph that do not have a 2D/3D equivalent object will be removed when converting the graph type.

You can convert from a 3D XYZ graph to a 2D graph or between 2D XY graph and 3D XY graph types. However, you cannot convert a 2D graph into a 3D XYZ graph. If a 2D graph is selected when **Graph to 2D/3D** is clicked, the graph will convert to a 3D XY graph.

Calculate Area

The **Graph Tools | Plot Tools | Calculate Area** command computes the area under a line/scatter plot, ribbon/wall plot, or 3D XYZ line/scatter plot. When calculating area for 3D XYZ line/scatter plots, the area is calculated for the X, Y plane. The area is reported in the graph's X, Y units using zero as the base line.

To Calculate the Area:

1. Create a line/scatter, ribbon/wall, or 3D XYZ line/scatter plot.
2. Select the plot in the Object Manager or plot window.
3. Click the **Graph Tools | Plot Tools | Calculate Area** command.
4. Enter a baseline value into the **Area Baseline Value** dialog and click the *OK* button.

The baseline value is the Y value used to calculate the area. The area is calculated from the curve to the baseline value.

After the **Calculate Area** command is selected, a report window opens containing the area and information such as the data file, X column, and Y column used to create the plot. The area is reported in the graph's X, Y units.

Area Tip

The area is calculated by finding the area between the plot and baseline value entered in the **Area Baseline Value** dialog. If any part of the plot extends below the baseline value, a negative area is calculated and this value is added to the total area. The area report displays area *Above Baseline Area*, *Below Baseline Are*a, and *Total Area*.

The X values are selected based on the X values that are shown in the plot. All of the plot is used to calculate the area. If you want the area only under a certain range of X values, you need to limit the plot to only that range. The easiest way to do this is to set the *Minimum* and *Maximum* rows for the plot or to clip the plot to the axis limits.

Grapher does not interpolate between data points. Rather, the area is calculated between each adjacent set of XY points. **Grapher** sums these areas to display the final area value.

Axis Types

In **Grapher**, two axes are automatically created for each 2D graph, 3D graph, and XY contour map. Three axes are created for 3D XYZ graphs, XZ contour maps, and surface maps. Axes are named according to the type of axis and the order in which they are created in the graph. For example, a line/scatter plot initially contains two axes: X Axis 1 and Y Axis 1. If X axes are added to the graph, they are sequentially numbered (X Axis 2, X Axis 3, etc.). 3D XYZ graphs, XZ contour maps, and surface maps have a Z axis in addition to the X axis and Y axis.

Axis Limits

Axis limits approximate the limits of the data file used to create the graph, depending on the tick mark spacing. The tick mark spacing is automatically scaled so a reasonable number of tick marks are drawn along each axis. Tick mark spacing and label format parameters can be independently specified for each axis on the graph. Tick labels and axis titles can also be moved with the Graph Tools | Plot Tools | Move Labels command.

Types of Axes

There are four types of axes in **Grapher**: standard, angle, box-whisker, and stiff X axes.

Standard Axes

Standard axes are included in the following plots:

Basic Graphs	**Bar Graphs**	**Polar Graphs** (radius axis)	**Ternary Graphs**	**Specialty Graphs**	**Statistical Graphs**	**Contour Surface Graphs**
Line Scatter Line/Scatter Step Function Parametric Function Bubble	Vertical Bar Horizontal Bar Vertical Floating Bar Hori-	Polar Line Polar Scatter Polar Line/Scatter Polar Class Polar 1	Ternary Scatter Ternary Line/Scatter Ternary Line Ternary Class Ternary	High-Low-Close High-Low-Close Candlestick 1 Point Vector	Vertical Histogram Horizontal Histogram 3D Vertical Histogram 3D Hori-	XY Contour Data Map XZ Contour Data Map XY Contour

Class 3D Ribbon 3D Wall 3D Ribbon Step 3D XYZ Line/Scatter 3D Function 3D Parametric Function 3D Bubble 3D Class Scatter	zontal Floating Bar Vertical Category Bar Horizontal Category Bar 3D Vertical Bar 3D Horizontal Bar 3D Vertical Floating Bar 3D Horizontal Floating Bar 3D XYZ Vertical Bar 3D XYZ Horizontal Bar 3D XYZ Vertical Floating Bar 3D XYZ Horizontal Float-	Point Vector Polar 2 Point Vector Polar Function Polar Parametric Function Polar Bar Rose Wind Radar (all axes)	Bubble	2 Point Vector 3D 2 Point Vector XYZ-dx, dy, dz Vector 2D Stiff (Y axis)	zontal Histogram Box-Whisker Notched Box-Whisker Q-Q Normal Q-Q	Grid Map XZ Contour Grid Map XY Contour Function Map XZ Contour Function Map Surface Data Map Surface Grid Map Surface Function Map

ing Bar

Angle Axes

Angle axes are included in the following plots:

Polar Graphs
Polar Line
Polar Scatter
Polar Line/Scatter
Polar Class
Polar 1 Point Vector
Polar 2 Point Vector
Polar Function
Polar Parametric Function
Polar Bar
Rose
Wind

Box Plot Axes

Box plot axes are included in box plots and in notched box plots.

Stiff X Axes

Stiff X axes are included in stiff plots.

Standard Axes

Standard axes are available on most graph types. The standard axis scale can be linear, logarithmic, natural logarithmic, or have a probability scale. All properties of the axis can be altered. Axes can be added to a graph by clicking one of the **Home | Add to Graph | Axis** commands.

Creating a New Standard Axis

To add a new standard Y axis to an existing graph:

1. Click the graph in the Object Manager or plot window to select it.
2. Click the **Home | Add to Graph | Axis | Y Axis** command.
3. In the Position Axis dialog, select the desired position and click *OK*. The axis is added to the existing graph.

Editing an Existing Standard Axis

To change the features of a standard axis, click once on the axis in either the plot window or the **Object Manager** to select it. The properties of the selected axis are displayed in the Property Manager.

Multiple axes can be selected and edited at once. To select multiple axes, click on the first axis to select it. Hold down the CTRL key and click on the second axis In the **Object Manager**.

Click the following tabs in the **Property Manager** to change different properties:

Axis

Break Axis

Ticks

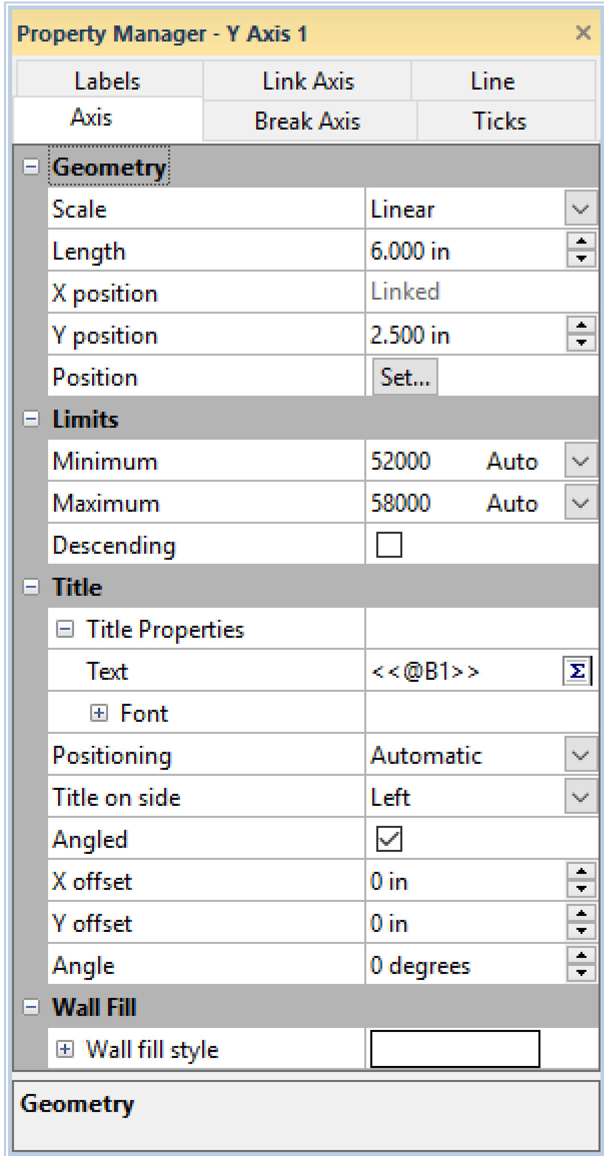
Labels

Link Axis

Line

Axis Properties

The **Axis** page for a selected standard axis provides a way to change the scale, set the length and starting position, set the axis limits, and create a title on a standard axis. The selected axis properties appear in the Property Manager. The **Axis** page for a box plot axis and stiff plot axis includes a limited set of the standard axis properties. The ternary plot axis is based on a standard axis, but uses different *Limits* properties.



*Edit the axis properties on the **Axis** tab in the **Property Manager**.*

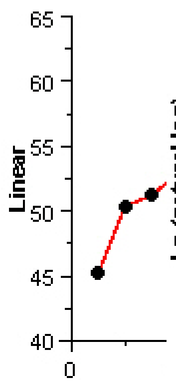
Scale

The axis scale can be *Linear*, *Log (base 10)*, *Probability*, *Probability (% labels)*, or *Ln (natural log)*. To change the *Scale*, click on the existing option. Select the new scale format from the list.

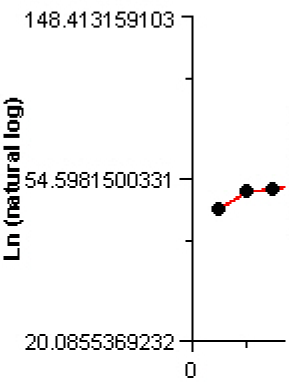
- *Linear* axes default to a range that covers all of the data. Tick marks are spaced so that the tick mark labels do not overlap.
- The data column used for a *Log (base 10)* axis should not contain values equal to or less than zero. If such values are present, the plot only displays values greater than zero. A warning message is

displayed after selecting *Log (base 10)* if your data contains values less than 0.

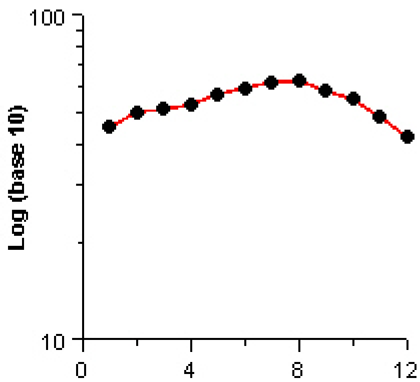
- Probability axis data must be percentages, though the axes can have percent (*Probability (% labels)*) or proportion labels (*Probability*). The data must be between 1E-5 (0.001%) and 0.99999 (99.9999%). All data values outside this range are excluded from the plot. The probability axis is a normal probability axis.
- The *Ln (natural log)* option is similar to the *Log (base 10)* option, except a natural log is used.



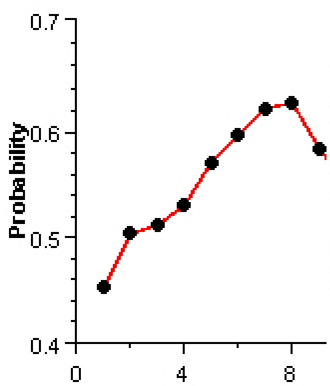
The Y AxisScaleis set toLinear.



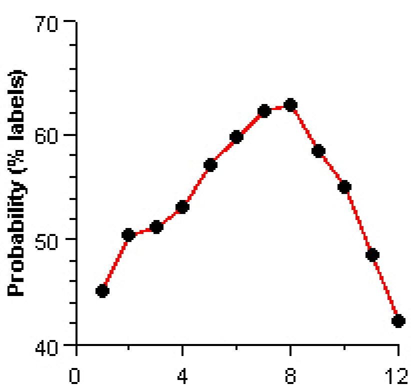
The Y Axis Scale is set to Ln (natural log).



The Y Axis Scale is set to Log (base 10).



The Y Axis Scale *is set to* Probability*.*



The Y Axis Scale is set to Probability (% labels)*.*

When *Link axis scale* option on the Link Axis tab is checked for a dependent axis, the *Scale* option on the **Axis** tab displays *Linked* in the **Property**

Manager. To change the *Scale* for the dependent axis, select the controlling axis and change the *Scale*.

Length

You can change the axis length by typing a new number into the *Length* box. The *Length* is in page units. The default length is 6.000 inches (15.24 cm) for 2D plots and 5.000 inches (12.7 cm) for 3D plots. Axes must be between 0.010 and 200 inches (0.0254 and 508 centimeters). To change the *Length,* highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the value.

When *Link length* is checked for a dependent axis on the Link Axis tab, the *Length* option in the *Axis Properties* section on the **Axis** tab displays *Linked* in the **Property Manager**. To change the *Length* for the dependent axis, select the controlling axis and change the *Length*.

X Position

The *X position* option sets the horizontal position of the selected axis. The *X position* is in page units. To change the *X position*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the value.

When *Link X position* is checked for a dependent axis on the Link Axis tab, the *X position* option in the *Axis Properties* section on the **Axis** tab displays *Linked* in the **Property Manager**. To change the *X position* for the dependent axis, select the controlling axis and change the *X position*.

Y Position

The *Y position* option sets the vertical position of the selected axis. The *Y position* is in page units. To change the *Yposition*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the value.

When *Link Y position* is checked for a dependent axis on the Link Axis tab, the *Y position* option in the *Axis Properties* section on the **Axis** tab displays *Linked* in the **Property Manager**. To change the *Y position* for the dependent axis, select the controlling axis and change the *Y position*.

Position

Click the *Set* button next to the *Position* option to open the Position Axis dialog. The **Position Axis** dialog moves an axis relative to another axes.

Radius Axis Angle

For polar radius axes, the *Axis angle* option is used to set the angle at which the radius axis is to be drawn. Angles are in degrees. 90 degrees points to the right, 0 degrees points up. The *Axis angle* must be between 0 and 360 degrees. To enter an angle, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Axis Limits

The *Limits* section controls the axis range. Click the next to *Limits* to see the following options. You can make the axis range smaller or larger by changing these settings. If you make the axis range smaller, the plot can be drawn past the axes. Clipping can be used to limit the range of the plot.

The axis minimum and maximum are displayed in the *Minimum* and *Maximum* fields. If *Auto* appears in the *Minimum* and *Maximum* fields, the axis range is automatically generated based on the data minimum and maximum. To limit the range of the axis, you can click the word *Auto* next to *Minimum* or *Maximum* and select *Custom*. You can then enter a new value into either the *Minimum* or *Maximum* box. To change the value, highlight the existing value and type a new value. Press ENTER on the keyboard to update the axis.

Click the word *Custom* and select *Auto* to go back to automatic axis limits. The word *Auto* will appear and the *Minimum* or *Maximum* will revert to the default value.

Logarithmic and probability axes cannot include values less than or equal to zero. The axis *Minimum* will revert back to the previous value if a value less than or equal to zero is typed in the *Minimum* field.

Axis Limits - Date/Time

If you have enabled date/time formatting by selecting the *Use date/time format* option on the Labels page, the axis limits can be set with dates and time. Click the next to *Axis limits* to see the following options.

To set the limits based on dates and time, click the current date next to the *Minimumdate/time* or *Maximum date/time* fields. In the Select Date/Time dialog, select the appropriate date and time. Click *OK* to make the change appear on the axis. Date values can also be typed directly in the box. When inputting date/time values directly in the **Property Manager**, date/times must always be entered as MM/dd/yyyy hh:mm:ss. No other formats are permitted in the date/time edit boxes in the **Property Manager.**

If an axis currently displays date and time formats, you can turn off date/-time formats on the Labels tab by clearing the *Use date/time format* option.

Axis Limits and Plotted Data

If the axis limits are set completely outside the data range, the plot will be drawn outside the axes. For example, if the data range is 100 to 500, but the *Minimum* value is changed to 10,000 and the *Maximum* value is changed to 50,000 then it appears as if no plot is displayed and only axes are displayed. The plot is actually drawn well outside of the axes, whether it can be seen in the program window or not. Click the Fit to Window command to see the plot and the axes. If the data are plotted far beyond the axes, use the axis properties in the **Property Manager** to reset the axis limits or delete the plot in the Object Manager.

If the axis limits are completely inside the data range, the plot will extend beyond the axes by default. If you wish to plot only data that fall within the axis limits, select the plot and set the *Clipping* properties to *Axis* on the Data Limits page.

Linked Axis Limits

When *Link limits* is checked for a dependent axis, the *Minimum* and *Maximum* options in the *Limits* section on the **Axis** tab displays *Linked* in the **Property Manager**. To change the *Minimum* or *Maximum* for the dependent axis, select the controlling axis and change the *Minimum* or *Maximum*.

Ternary Axis Limits

The *Limits* properties section is different when the axis is part of a ternary or piper diagram

- The *0 to 100 scale* check box changes the axis range from 0 - 1 to 0 - 100. Enabling this option for one axis automatically changes it for all three ternary diagram axes, all six durov plot axes, or all ten piper diagram axes
- The Reverse direction option is available for ternary plots. Select Reverse direction to rotate the ternary axes.
- Ternary plots have two modes for setting the axis limits. Click *Select* in the *Limits* field to set the axis limits by clicking and dragging in the plot. Click *Enter limits* in the *Advanced* field to type the desired axis limits in the Axis Limits dialog.

See the *Ternary Axis Tips* topic for more information about ternary axes.

Stiff Plot Axis Limits

The *Limits* properties section behaves differently for a stiff plot. The axis *Minimum* is the negative value of the left side maximum, and the axis *Maximum* is the right side maximum. For example, a stiff plot axis *Minimum* of -80 sets the left side maximum to 80. The *Minimum* value must be less than 0.

Descending

The Descending option flips the axis so that it increases in the reverse direction. Check the box next to the *Descending* option to reverse the axis. If *Descending* is checked, the X Axis values decrease to the right, or the Y Axis values decrease upward. *Descending* axes are not available on ternary graphs.

Axis Title

The *Title Properties* section controls the axis title text. Click the next to *Title Properties* to change the axis title text and font.

Title

Add a title to the axis by typing the axis title in the *Text* field. Math text instructions can be used in the title *Text* field. Click in the *Text* field to open the Text Editor dialog. For most graph types, when a graph is first created, the axis title is linked to the value in the first row of the worksheet for the associated data column in the plot. The *Text* field will show the linked cell number, for example *<<@A1>>*.

Font

Click the next to *Font* to change the axis title font properties.

Positioning

The *Positioning* option sets the axis title location relative to the axis. To change the *Positioning*, click on the existing option and select a new option. Select *Automatic* to allow **Grapher** to automatically position the title on the axis. By default, the title is centered on the axis and it is located just beyond the tick marks and tick labels. If the axis properties are changed, the title position adjusts for these changes. For example, if the tick labels are rotated 90 degrees, the title is placed farther from the axis to adjust for the additional space used by the rotated labels.

To place the title directly on the axis line, select the *Relative* option. This option is useful in customizing the location of the axis title using the X and Y offsets.

Title on Side

The *Title on side* sets the position of the title relative to the axis. Select the *Right* or *Left* side of a Y Axis or the *Top* or *Bottom* side of an X Axis. To change the *Title on side*, click on the existing option. Select the new option from the list.

Angled

In 3D graphs, check the *Angled* box to draw the axis title at the same angle as the axis. If this box is not checked, the title is displayed parallel to the screen, regardless of how the graph is rotated. When *Angled* is checked, the title automatically changes to match the rotation of the graph when the graph rotation is changed.

X and Y Offset

The axis title can be positioned at a custom position by entering values into the *X offset* or *Y offset* boxes. Entering a positive value into the offset box moves the title up for the *Y offset* or to the right for the *X offset*. Entering a negative value in the offset box moves the title down for the *Y offset* or to the left for the *X offset*. To enter an offset, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Angle

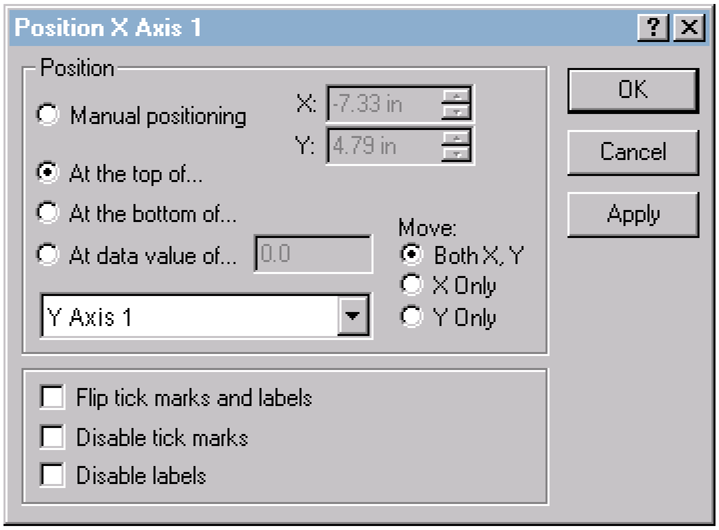
You can enter a number into the *Angle* box to rotate the title. Positive values rotate the title in a counter-clockwise direction. The *Angle* is specified in degrees. To enter an angle, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Axis Wall Fill

Click on the next to the *Wall fill style* option to control the 3D axis wall fill properties. The back wall properties are set by selecting the *Graph* object in the **Object Manager**. Click on the Line and Fill tabs to set the back wall line and fill properties.

Position Axis

You can control the standard, box-whisker plot X Axis, and stiff plot X Axis position when editing an axis, creating a new axis, or adding a plot to an existing axis. Click the *Set* button next to the *Position* option on the **Axis** page to open the **Position Axis** dialog and set positioning options. The selected axis properties are displayed in the Property Manager. If you move an axis, the plot is moved relative to the axis movement.



Control the axis position in the ***Position Axis*** *dialog.*

Manual Positioning

Use *Manual positioning* to set a specific axis location on the page. The axis is positioned using the axis *X* and *Y* location in inches or centimeters. The measurements are from the lower left corner of the page. The starting point is the left edge of the X Axis and the bottom edge of a Y Axis.

Automatic Positioning

There are three automatic positioning options that locate an axis relative to another axis.

- If an X Axis is selected or added, the default position options are to place the X Axis *At the top of* or *At the bottom of* a Y Axis. If you would like to place the X Axis to the left of or right of another X Axis, select the X Axis from the list at the bottom of the *Position* group. If an X Axis is selected from the list, the options change to *At the right of* and *At the left of*.
- If a Y Axis is edited or added, the default position options are to place the Y Axis *At the right of* or *At the left of* an X Axis. If you would like to place a Y Axis at the top of or bottom of another Y Axis, select the Y Axis from the list at the bottom of the *Position* group. If the Y Axis is selected from the list, the options change to *At the top of* and *At the bottom of*.
- If a Z Axis is selected or added, the default position options are to place the Z Axis *At the top of* or *At the bottom of* a Y Axis or *At the right of* or *At the left of* an X Axis. If you would like to place the Z Axis relative to a Y Axis, select the Y Axis from the list at the bottom of the *Position* group. If the Y Axis is selected from the list, the option to change to *At the top of* and *At the bottom of*.

- To place the axis at a specific data location, click the *At data value of* option and enter the data value into the box.

Moving Axes

Axes can be positioned by moving the axis vertically, horizontally, or both.

- Select *Both X, Y* to move an axis in both directions.
- Select *X Only* to only move the axis horizontally. The axis keeps its current vertical position and only moves horizontally.
- Select *Y Only* to only move the axis vertically. The axis keeps its current horizontal position and only moves vertically.

Flip Tick Marks and Labels

Check the box next to the *Flip tick marks and labels* option to place the tick marks and labels on the opposite side of the existing tick marks and labels.

Disable Tick Marks

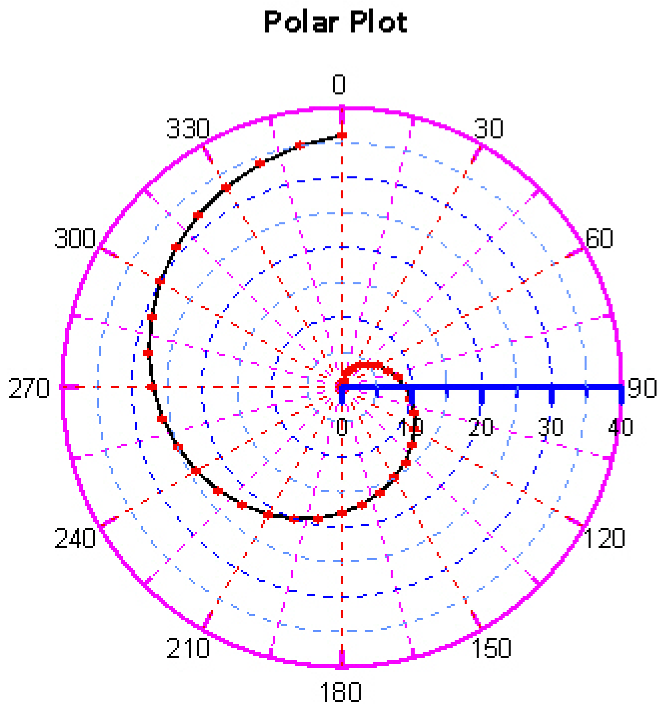
Check the *Disable tick marks* box to turn off tick marks display on the axis. The display can be turned on again by checking the *Show ticks on*options on the**Tick Marks**tab.

Disable Labels

Check the *Disable labels* box to turn off the label display from the axis. The display can be turned on again by checking the *Show labels* option on the **Tick Labels** tab.

Angle Axes

Angle axes appear on polar-type plots. Angle axes are created when the polar type plots are created. Angle axes cannot be added to an existing graph.



In this example, the Angle Axis is displayed in magenta.
The Radius Axis (Standard Axis) is displayed in blue.

Editing an Existing Angle Axis

To change the features of an angle axis, click once on the axis in either the plot window or the **Object Manager** to select it. The properties of the selected axis are displayed in the Property Manager.

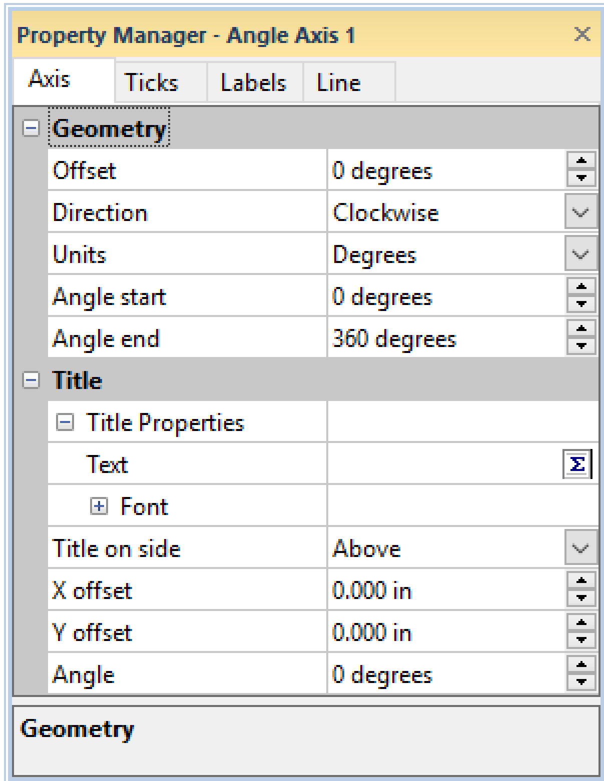
Multiple axes can be selected and edited at once. To select multiple axes, click on the first axis to select it. Hold down the CTRL key and click on the second axis In the **Object Manager**.

Click the following tabs in the **Property Manager** to change different properties:

Axis
Ticks
Labels
Line

Axis Properties - Angle Axis

The **Axis** page for a selected angle axis provides a way to create a title, set an angle offset, set the axis units, and set the direction on an angle axis. The selected axis properties appear in the Property Manager.

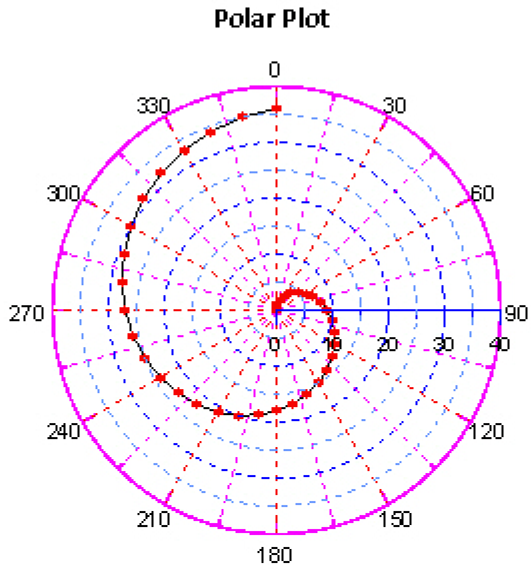


*Edit the axis properties on the **Axis** tab in the **Property Manager**.*

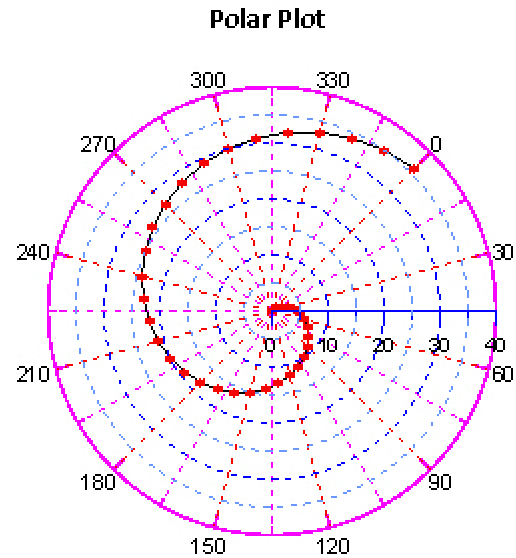
Offset

Rotate the angle axis by entering a number into the *Offset* box. The *Offset* is measured in degrees and must be a value between -360 and 360 degrees. Zero is placed at the top of the graph. Positive values rotate the axis clockwise and negative numbers rotate the axis counter-clockwise. For example, an entry of 90 degrees in the *Offset* box changes the zero location to point to the right of the graph; conversely, an entry of -90 degrees in the *Offset* box changes the zero location to point to the left of the graph.

To change the *Offset*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the offset.



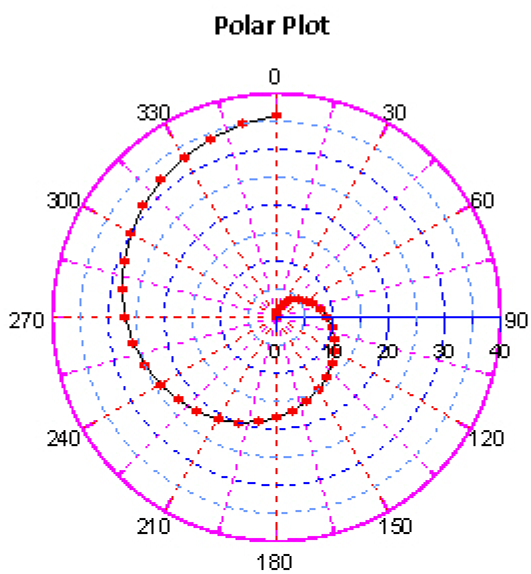
This angle axis has an Offset *of 0 degrees.*



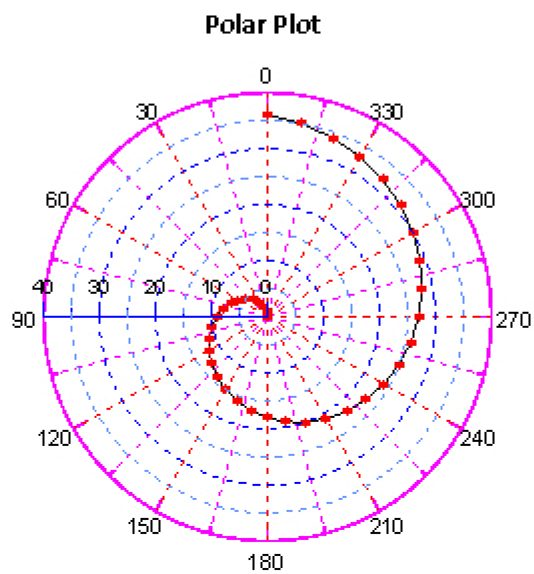
*This angle axis has an*Offset*of 45 degrees.*

Direction

The angle axis *Direction* can increment the axis in the *Clockwise* or *Counterclockwise* direction. The default is *Clockwise*. To change the *Direction*, click on the current option and select the new option from the list.



This polar plot Direction *is set to* Clockwise*.*



This polar plot Direction *is set to*Counterclockwise*.*

Units

Angle axis *Units* can be *Degrees* (0 to 360), *Radians* (0 to 6.283), or *Grads* (0 to 400). The data must match the unit type.

There are two methods to display radian axis labels as increments of Pi:

- On the Labels page, set the *Label value divisor* to 3.14159265, and add pi symbol *Suffix* if desired.
- Create value and label columns in a worksheet, and set the *Label source* to *From worksheet* on the **Labels** page.

Angle Limits (Angle Start and Angle End)

The *Angle start* and *Angle end* settings allow you to clip polar-type plots to a portion of the entire angle axis. If the angle is set to anything less than 360 total degrees, the angle axis is drawn only to the angle limit. For example, if *Angle start* is set to 90 and *Angle end* is set to 270, only half a circle is drawn for the angle axis rather than a full 360 degree circle. Any data that exceed the angle limits are clipped.

The *Angle start* and *Angle end* settings are always in degrees, regardless of the *Units* specified.

To change the *Angle start* and *Angle end* values, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Axis Title

The *Title Properties* section controls the axis title text. Click the next to *Title Properties* to change the axis title text and font. By default, the title is centered above the angle axis and it is located just beyond the tick marks and tick labels. If the axis properties are changed, the title position adjusts for these changes. For example, if the labels are rotated to 90 degrees, the title is placed farther from the axis to adjust for the additional space used by the rotated labels.

Title

Add a title to the axis by typing the axis title in the *Text* field. Math text instructions can be used in the title *Text* field. Click in the *Text* field to open the Text Editor dialog. When a graph is first created, the axis title is linked to the value in the first row of the worksheet. The *Text* field will show the linked cell number, for example *<<@A1>>*.

Font

Click the next to *Font* to change the axis title font properties.

Title on Side

The *Title on side* sets the position of the title relative to the axis. Select the *Above* or *Below* side of an angle axis. To change the *Title on side*, click on the existing option. Select the new option from the list.

X and Y Offset

The axis title can be positioned at a custom position by entering values into the *X offset* or *Y offset* boxes. Entering a positive value into the offset box moves the title up for the *Y offset* or to the right for the *X offset*. Entering a negative value in the offset box moves the title down for the *Y offset* or to the left for the *X offset*. To enter an offset, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

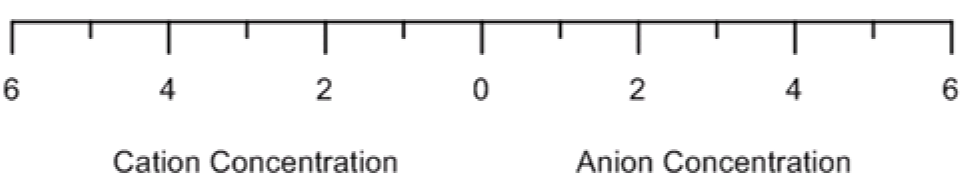
Angle

You can enter a number into the *Angle* box to rotate the title. Positive values rotate the title in a counter-clockwise direction. The *Angle* is specified in degrees. To enter an angle, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Stiff Plot Axes

Stiff plot X Axes appear on stiff plots. The values of the cations and anions are plotted in milliequivalents per liter on the stiff plot axis. The left side of the axis shows the cation concentrations and the right side shows the anion concentrations. The farther a point is from the center, the larger the ionic concentration.

Stiff axes are created when the stiff plot is created. Stiff axes cannot be added to an existing graph.



An example stiff plot axis with the two halves of the axis labeled.

Editing an Existing Stiff Axis

To change the features of a stiff axis, click once on the axis in either the plot window or the **Object Manager** to select it. The properties of the selected axis are displayed in the Property Manager.

Multiple axes can be selected and edited at once. To select multiple axes, click on the first axis to select it. Hold down the CTRL key and click on the second axis In the **Object Manager**.

Click the following tabs in the **Property Manager** to change different properties:

Axis

Ticks

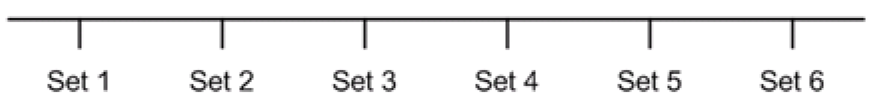
Labels

Line

Box Plot Axes

Box plot axes appear on box plots and notched box-whisker plots. Box plot axes contain the category value for each column in the worksheet. Box plot axes are X axes for vertical box plots and Y axes for horizontal box plots. The labels are the column header labels.

Box plot axes are created automatically when the box plot or notched box plot is created. Box plot axes cannot be added to an existing graph.



An example box axis shows a set from each column. The set names are from the column headers.

Editing an Existing Box Plot Axis

To change the features of a box plot axis, click once on the axis in either the plot window or the **Object Manager** to select it. The properties of the selected axis are displayed in the Property Manager.

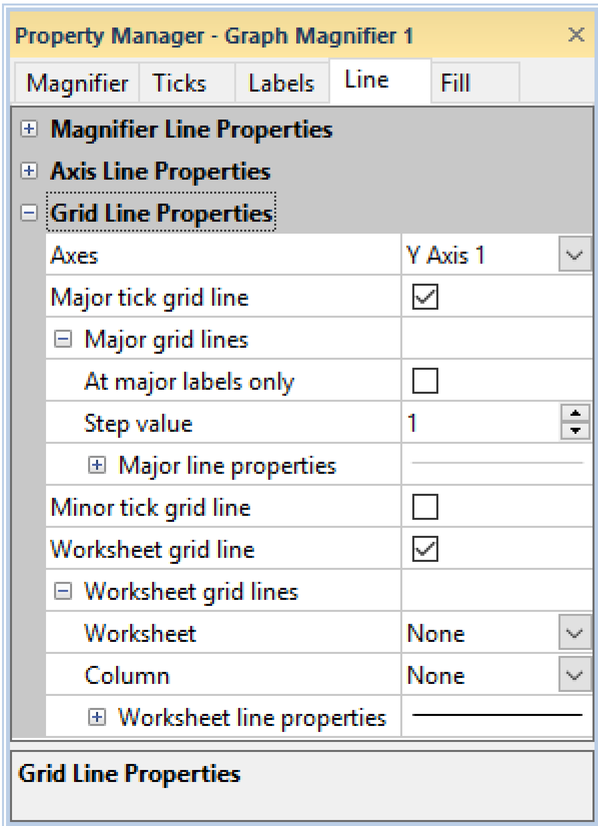
Multiple axes can be selected and edited at once. To select multiple axes, click on the first axis to select it. Hold down the CTRL key and click on the second axis In the **Object Manager**.

Click the following tabs in the **Property Manager** to change different properties:

Axis
Ticks
Labels
Line

Grid Lines

Grid lines are available on standard, angle, and stiff plot X axes. Grid line properties are edited on Line page in the Property Manager. On 3D axes, the grid lines appear at the front of the graph. Set default grid line properties through File | Defaults under the *Grid Lines* section of a respective axis type. The selected grid line properties then appear in the Property Manager.



Display grid lines and alter grid line properties on the ***Line*** *tab in the* ***Property Manager****.*

Axes

For a graph magnifier, the *Axes* option sets the axis for which the grid lines are being set. To change the axis, click on the current axis name and select the desired axis from the list.

Parallel Axis

The *Parallel axis* defines the grid line direction and length. Grid lines are drawn parallel to the axis selected in the *Parallel axis* field, and grid lines are drawn to the same length as the axis selected in the *Parallel axis* field. If an X Axis is selected in the **Object Manager**, all the Y axes in the graph appear in the *Parallel axis* list. If a Y Axis is selected in the **Object Manager**, all of the X axes in the graph appear in the *Parallel axis* list. To change the axis, click the current axis name and select the desired axis.

Display Grid Lines

Grid lines can be drawn at major ticks, minor ticks, and locations specified by worksheet values. Select the *Major tick grid line* option to display grid lines at major tick marks. Select the *Minor tick grid line* option to display grid lines at minor tick marks.

At Labels Only

In addition, grid lines can be displayed only at labeled tick marks. Check the boxes next to *At major labels only* or *At minor labels only* to display grid lines only when a label is displayed for a tick mark. *At major ticks* must be checked if you would like to select *At major labels only*. *At minor ticks* must be checked if you would like to select *At minor labels only*.

Step Value

Use the *Step value* to skip grid lines. For example, if the step factor is set to three, every third grid line is displayed. To change the value, highlight the existing number and type a new number. Press ENTER on the keyboard to make the change. Alternatively, click the next to *Step value*to increase or decrease the value.

Worksheet Grid Lines

Select the *Worksheet grid lines* option to display grid lines at values in a worksheet. The worksheet must contain a data column that contains the values where the grid lines should appear.

Worksheet

Specify the worksheet next to the *Worksheet* option. To select or change the worksheet, click the word *None* next to the *Worksheet* field to select the worksheet containing the grid line column. A list appears from which you can select an existing worksheet to open. Alternatively, you can choose the *Browse* option to open the **Open Worksheet** dialog and select a different worksheet file. Click the *Open* button to exit the **Open Worksheet** dialog.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

Column

The *Column*option lists all of the columns in the worksheet. Select the appropriate column that contains the grid line values. All values in the column are displayed as grid lines, so it is advised that a separate column be created for the grid line display. To select a column, click on the current option and select the desired column from the list.

Line Properties

The *Major line properties*, *Minor line properties*, and *Worksheet line properties* sections contain the line properties for the various grid lines.

Custom Grid Line Spacing Example

Grid lines can be added to specific locations on the axis through worksheet grid lines.

To add custom grid lines to the graph:

1. Type the data values of the grid lines into a column in a data file. For example, to place grid lines at axis values three, seven, and nine, enter 3, 7, and 9 into an empty data column. This data file does not need to be the same data file used to create the graph.
2. In the plot window or **Object Manager**, click on the axis to select it.
3. In the **Property Manager**, click on the **Line** tab.
4. Click the ⊞ next to *Grid Line Properties*.
5. Click the ⊞ next to *Worksheet Lines*.
6. Check the box next to the *Worksheet grid lines* option.
7. Click the word *None* next to the *Worksheet* field to select the worksheet containing the grid line column. A list appears from which you can select an existing worksheet to open. Alternatively, you can choose the *Browse* option to open the **Open Worksheet** dialog and

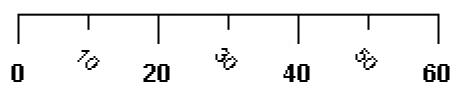
select a different worksheet file. Click the *Open* button to exit the **Open Worksheet** dialog.

8. Select the grid line column from the *Column* list.
9. Click the ⊞ next to the *Worksheet line properties* field. Set any line properties for the grid lines.

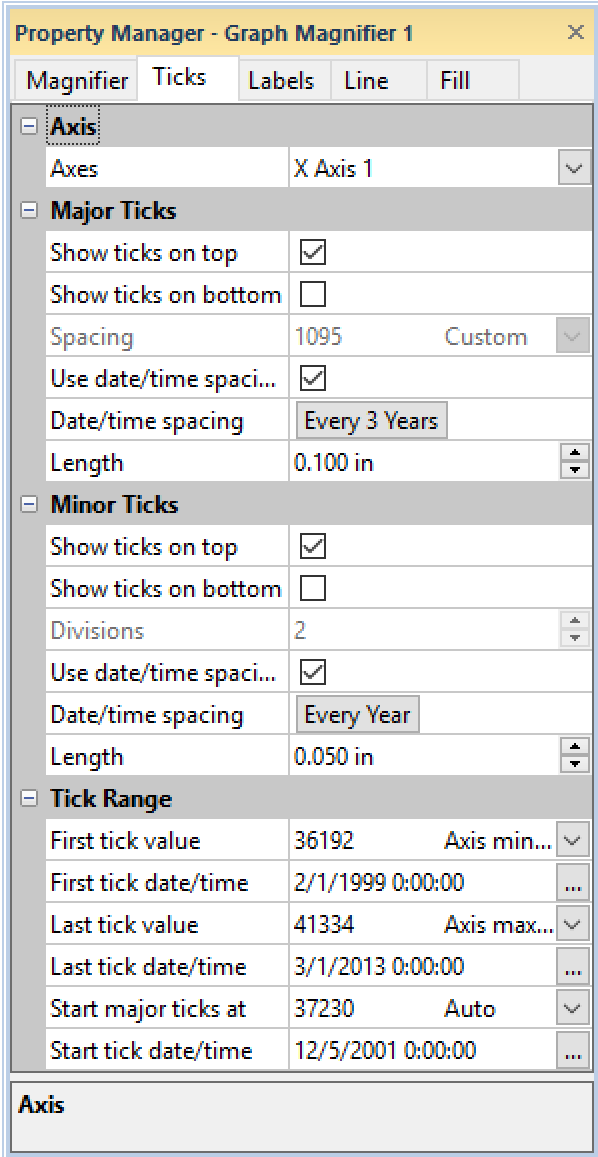
The grid lines are automatically updated on the axis.

Tick Marks

Set major and minor tick mark spacing, tick length, and tick range in the axis properties **Ticks**page. The selected axis properties appear in the [Property Manager](). There are two types of tick marks, major and minor. Minor tick marks subdivide the region between the major tick marks.



This example axis shows major tick marks in bold and minor tick marks on a 45 degree angle.



*Set the tick mark spacing options on the **Ticks** tab in the **Property Manager**.*

Axes

For a graph magnifier, the *Axes* option sets the axis for which the tick marks are being set. To change the axis, click on the current axis name and select the desired axis from the list. Note, if the options on this tab are not available, the *Axes on edge* option is checked on the Magnifier tab. To change the tick mark position settings, click on the **Magnifier** tab and clear the *Axes on edge* option first.

Show Ticks

Ticks can be shown on either side of an axis line. When editing an X Axis or Z Axis, you have the option to *Show ticks on top* or *Show ticks on bottom* of the axis. You can check both of these boxes to place tick marks on both sides of the axis. When editing a Y Axis, these options change to *Show ticks on right* and *Show ticks on left*. Tick marks can be located on both sides of the axis at the same time by checking the boxes next to both options.

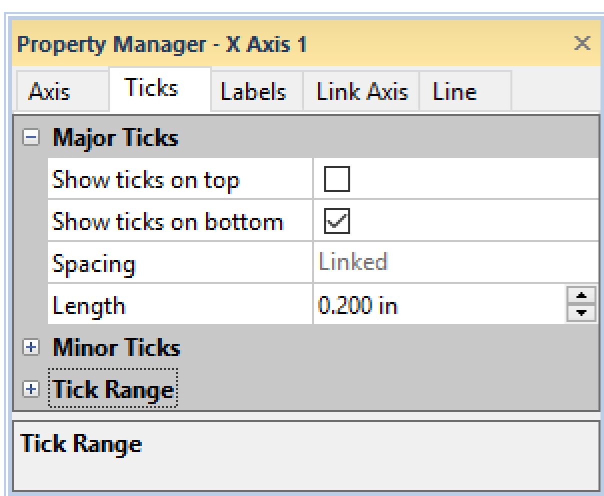
When editing an angle axis, the options are *Show ticks on inside* or *Show ticks on outside* of the angle axis.

Major Tick Mark Spacing

Grapher automatically generates the major tick spacing if *Auto* is selected for the *Spacing*. The *Spacing* is in the axis units. A maximum of 1000 tick marks can be displayed on any axis, so the *Spacing* will automatically change to prevent additional tick marks over the limit from being created. The custom spacing option is available for standard linear-scale axes and angle axes. If the *Spacing* option is not available, change the *Scale* on the **Axis** page or set the Label source to *Automatic* on the **Labels** page.

If *Auto* is selected for the *Spacing*, **Grapher** sets a reasonable number of tick marks between the minimum and maximum values on the axis. To change the *Spacing*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. To return to the default values, click the word *Custom* and select *Auto.Spacing* will revert to the default value.

When *Link tick spacing* optionis selected on the Link Axis tab for a dependent axis, the *Spacing* option on the **Ticks** tab displays *Linked* in the **Property Manager**. To change the *Spacing* for the dependent axis, select the controlling axis and change the *Spacing*.



When the Link tick spacing *box is checked on the* ***Link Axis*** *tab, the axis shows* Linked *next to* Spacing *on the* ***Tick Marks*** *tab. Tick mark spacing changes must be made to the controlling axis.*

Date/Time Major and Minor Tick Mark Spacing

If you have enabled date/time formatting, you can set the major and minor tick marks to be spaced at specific date/time intervals. To turn on major date/time spacing, check the box next to the *Use date/time spacing* option in the *Major Ticks* section. To turn on minor date/time spacing, check the box next to the *Use date/time spacing* option in the *Minor Ticks* section.

To set the date/time interval between ticks, click the current spacing next to *Date/time spacing*. In the **Date/Time Spacing** dialog, set the interval. Set the first box to the desired value and the second box to the desired time period. Setting the *Date/Time spacing* to *1 Year* creates a tick mark every year. Setting this to *6 Month* creates one tick mark every six months.

Major and minor tick marks can have different date/time spacings. For example, major tick marks can be set to display a tick mark and label every year. Minor tick marks can be set to display a tick mark and label every 3 months.

Minor Tick Mark Divisions

Set the number of divisions between major ticks by entering a number into the *Divisions* box in the *Minor Ticks* section. For example, if ten is entered into the *Divisions* box, there are nine tick marks and ten spaces between each major tick. The *Divisions* option is available for linear and natural log scale standard axes and for angle axes. To change the number of *Divisions*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Length

The length of the major and minor tick marks is set in the *Length* field. The *Length* is set in page units and can be any value between 0 and 6 inches (0 and 15.24 centimeters). To change the value, highlight the existing number and type a new number. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

Tick Range

The *Tick Range* section controls the tick starting and ending positions along a given axis range for standard axes.

First Tick and Last Tick

The *First tick value* and *Lasttick value* can be set to the *Axis minimum*, *Axis maximum*, *Data minimum*, *Data maximum*, or you can select *Custom* starting and ending tick values. To change the *First tick value* or *Last tick value*, click on the current option. Select the desired option from the list. To set a custom value, highlight the current value and type a new value. Press ENTER on the keyboard to make the change.

The axis minimum and maximum limits are set on the Axis tab in the *Limits* section. When the *First tick value* and *Last tickvalue* are set to *Axis minimum* and *Axis maximum*, **Grapher** automatically updates the ticks when the axis limits change.

Data minimum or *Data maximum* places the first tick mark at the closest tick to the minimum data point, and the last tick at the closest to the maximum data point. The spacing of the major tick marks determine how far the first tick is away from the first data point. For example, if the tick mark spacing is set to five, the data minimum is three, and the *Firsttickvalue* is set to the *Data minimum*, the first tick is five.

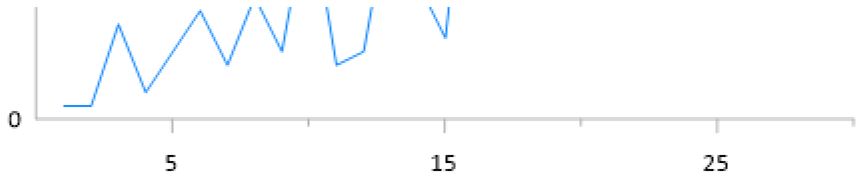
Select *Custom* to enter specific starting or ending ticks in the *First tick value* and *Last tick value* boxes. The custom value must be within the range of the axis minimum and axis maximum. To use a larger or smaller number, first set the axis minimum and maximum on the **Axis** tab in the *Limits* section. To change the *First tick value*or*Last tick value*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change.

By default, most axes set the *First tick value* to *Axis minimum* and *Last tick value* to *Axis maximum*. However, an XYZ graph X axis sets the *Last tick value* to *Data maximum* by default. This makes it less likely the last X axis tick label and first Z axis tick label will intersect. However, the labels may still intersect with certain data sets.

Start Major Ticks At

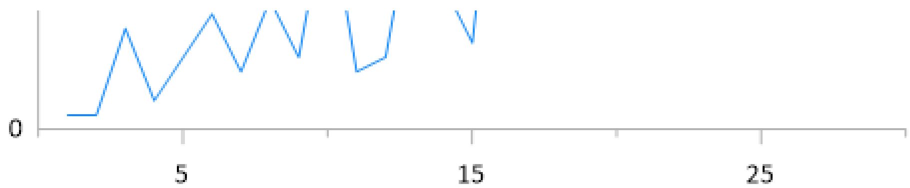
To start the tick marks at a specific value, highlight the current *Start major ticks at* value and type a new value in the *Start major ticks at* field. For example, if the axis minimum is two and the tick spacing is two, the first tick is two if the *Axis minimum* option is selected. If 3 is entered into the *Start major tick at* box, the first tick is three, the next major tick is five, and so on.

No minor ticks are displayed before the *Start major ticks at* value. In the following image, the axis range is 0 to 30, and the *Start major ticks at* value is 5. Notice there is no minor tick at X=0.



Start major ticks at *is set to 5 in this example, and there is no minor tick mark at X=0.*

In the next image, the *Start major ticks at* value is set to -5. The axis range is still 0 to 30, and now a minor tick is displayed at X=0. Set the *Start major ticks at* value to less than the axis minimum if you wish to start with a minor tick on the axis.



Start major ticks at *is set to -5 in this example, and there is a minor tick mark at X=0.*

Date/Time Tick Mark Range

If you have enabled date/time formatting, you can set the tick mark range to begin and end at a specific date and time. To set the starting date/time, click the ... next to the date next to *First tick date/time*. In the Select Date/Time dialog, set the starting date and time. Click *OK*. Dates can also be edited directly in the **Property Manager** by highlighting the existing value and typing a new value. Press ENTER on the keyboard to make the change. When inputting date/time values directly in the **Property Manager**, date/times must always be entered in the *MM/dd/yyyy hh:mm:ss* format. No other formats are permitted in the date/time edit boxes in the **Property Manager**.

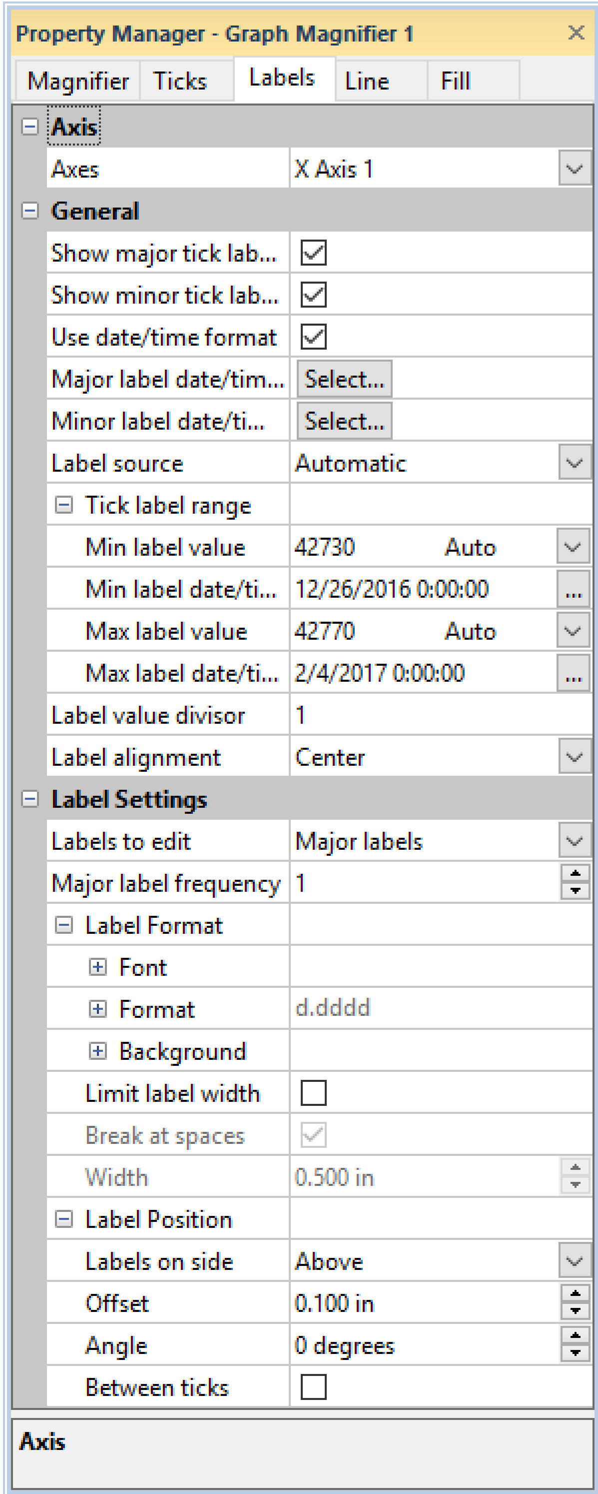
To set the last date/time tick mark, click the ... next to the date next to *Last tick date/time*. In the Select Date/Time dialog, set the ending date and time. Click *OK*. Tick marks are positioned between the *First tick date/-time* and *Last tick date/time* based on the *Spacing* in the *Major Ticks* section. Dates can also be edited directly in the **Property Manager** by highlighting the existing value and typing a new value. Press ENTER on the keyboard to make the change.

Ternary and Piper Diagram Tick Mark Direction

Ternary diagrams and Piper diagrams have a *Tick direction* option. Select *Perpendicular* to draw the tick marks perpendicular to the axis. Select *Angled* to draw the tick marks as an extension of the ternary grid lines from all axes. The *Angled* option creates v-shaped tick marks. Select *Grid line direction* to draw tick marks parallel to the axis grid lines. The *Grid line direction* option makes ternary and piper diagrams easier to read.

Tick Labels

Customize the major and minor tick labels in the axis properties **Labels** page. The selected axis properties appear in the Property Manager. The *General* section includes properties for defining which labels appear and the source for the label values. The *General* section properties apply to both major and minor labels. The *Label Settings* section includes properties for the appearance of the labels, including font, format, background, and position. The *Label Settings* section properties can be set independently for major and minor tick labels. Tick mark labels can be positioned with the *Label Position* properties or manually moved with the Move Labels command.



Set major and minor tick labels on the ***Tick Labels*** *tab in the* ***Property Manager****.*

Axes

For a graph magnifier, the *Axes* option sets the axis for which the tick labels are being set. To change the axis, click on the current axis name and select the desired axis from the list.

General

The *General* section includes properties for defining which labels appear and the source for the label values. The *General* section properties apply to both major and minor labels.

Show Labels

Select the *Show major tick labels* option to turn on major tick labels. Select the *Show minor tick labels* option to turn on minor tick labels. Minor labels cannot be displayed with probability axes.

Date/Time Formatting

If the data being plotted is in date/time format in the worksheet, select the *Use date/time format* option. The labels will be displayed in a date/-time format. The labels appear as numbers when the *Use date/time format* option is cleared.

- If you have ***date/time*** data, set the *Label source* to *Automatic* and select the *Use date/time format* option to use date/time formatting for the tick labels.
- If you have unevenly spaced ***text*** date/time data, you can use *From worksheet* as the *Label source*. This allows you to set up the major tick mark locations and the labels that correspond with the tick marks.
- If you have evenly spaced ***numeric*** data and an evenly spaced time increment, you can use *Numeric date/time* as the *Label source*. This converts numeric data to date/time by specifying a date/time that corresponds to one of the numeric values and the date/time increment that corresponds to the change in the numeric values.
- When changing the *X column, Y column,* or *Z column* on the **Plot** tab to a date/time column from a numeric column, the *Use date/time format* option is automatically selected to match the new data. When changing the *X column, Y column,* or *Z column* on the **Plot** tab to a numeric column from a date/time column, the *Use date/time format* option is automatically cleared to match the new data.
- If your axis is displaying date/time labels and should not use date/-time formatting, clear the *Use date/time format* checkbox.

The *Use date/time* format option is automatically selected when an axis is used by only one plot and the plot's data column includes date/time values. If the axis is used by multiple plots, or if the data column isn't changed, the *Use date/time* format option will not be automatically updated.

Major and Minor Label Date/Time Format

When the *Use date/time format* option is selected, the *Major label date/-time format* and *Minor label date/time format* properties are available. Click *Select* to specify the date/time format for the labels in the Date/Time Format Builder dialog. The major and minor label date/time formats are specified independently. For example, the major tick labels can display month and year while the minor tick labels display only month.

Label Source

The *Label source* defines which values are used for the tick labels. There are three *Label source* options: *Automatic*, *Numeric date/time*, and *From worksheet*. To change the *Label source*, click on the current option and select the desired option in the list.

- *Automatic* creates numeric or date/time labels that are based on the axis minimum and axis maximum. *Automatic* labels update automatically when the axis limits change.
- *Numeric date/time* converts numeric values to date/time labels. Use this option **ONLY** if the data are numeric and organized in evenly spaced increments of time. This option is used when the data are numeric but represent date/time information. Click *Set* in the *Date/-time settings* field to tell **Grapher** what numeric value corresponds to a specific date/time. This option is not often used, but it can be useful if you have data that is collected in time intervals and you wish to convert it to specific dates and times.
- *From worksheet* lets you read labels directly from a data column. Select a *Worksheet*, *Data column*, *Label column*, and *Worksheet rows* to use worksheet labels. This option lets the axis display text or numbers for the tick labels and lets you specify the major tick mark locations.

Date/Time Settings

When the *Label source* is set to *Numeric date/time*, numbers can be assigned a date. This can be useful when you have only numbers in your worksheet and a numeric increment is equal to a time increment. After setting the *Label source* to *Numeric date/time*, click the *Set* button next to the *Date/time settings* option to open the Date/Time Labels dialog. Note that this option is not used when the data in the worksheet is already formatted as dates and times.

Worksheet Labels

When the *Label source* is set to *From worksheet*, axis data values can be associated with different numbers or text to be displayed as the label on the axis. This can be useful for labeling groups. After setting the *Label source* to *From worksheet*, the *Worksheet,Data in rows*, *Data column,Label column*, and *Worksheet rows* can be set. See the *Worksheet Labels* topic for examples.

When labels are defined from a worksheet, a worksheet must be created that contains the axis values in one column and the label values or text in another column. Specify the worksheet next to the *Worksheet* option. To select or change the worksheet, click the word *None* next to the *Worksheet* field to select the worksheet containing the label information. A list appears from which you can select an existing worksheet. Alternatively, you can choose the *Browse* option to open the **Open Worksheet** dialog and select a different worksheet file. Click the *Open* button to exit the **Open Worksheet** dialog.

Select the *Data in rows* option if your data file is formatted where each row includes one variable. When the *Data in rows* option is selected, all plot properties that require data values are specified by selecting a data row. This includes variables such as X and Y, data labels, worksheet ranges, etc. Properties that list column letters will update to list row numbers. When switching from plotting data in columns to plotting data in rows, **Grapher** may not be able to select the correct rows automatically. Verify the correct rows are selected.

The property descriptions below refer to data columns, but when *Data in rows* is selected the property lists will include rows.

NOTE: The worksheet columns are retained after changing the worksheet. If the *Data column* or *Label column* is blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to either *Data column* or *Label column* means that the column does not exist in the new worksheet.

Data and Label Columns

The *Data column*is the worksheet column that contains the actual axis values that should contain a label. These values are in axis units. The*Label column*is the worksheet column that contains the number or text to be displayed as the axis label. The *Data column* and *Label column* options contain a list of all the columns in the selected worksheet. Click on the column name next to the *Data column* and *Label column* fields to change the columns used to label the axis. In the list that appears, select the new column. If the first worksheet row contains header information, the header information appears next to the column letter.

Aside from the columns containing data there are two other options available for *Data column*: row number and sequence number. These options are available in the list that appears before the first column.

- Selecting the *Row number* option plots the data value on the axis with the row number. For example, if the first row is number two, the axis value is two.
- The *Sequence number* option plots the data value on the axis according to the total number of rows used. The sequence number always begins with the number one regardless of which rows are selected in the *Worksheet rows* section. Blank lines between rows are ignored when calculating the value. The sequence number increments by one when rows are adjacent or when rows are skipped.

NOTE: The worksheet columns are retained after changing the worksheet. If the *Data column* or *Label column* is blank after changing the *Worksheet*, click on the blank option and select the desired column. A blank next to either *Data column* or *Label column* means that the column does not exist in the new worksheet.

Worksheet Rows

Select the range of rows to plot in the *Worksheet rows* section. Click the ⊞ next to *Worksheet rows* to open the *Worksheet rows* section. The default rows are the first and last rows in the worksheet that contain data.

If *Auto* is selected for the *First row* and *Last row*, all of the rows containing data are used for the tick labels. To limit the rows, next to *First row* or *Last row,* click the word *Auto*. It will change to *Custom*. You can then enter a new row number into either the *First row* or *Last row* box. To change the value, either highlight the existing row number and type a new row number or click the to scroll to a new row number. Press ENTER on the keyboard to update the plot.

Click the word *Custom*to go back to automatic row selection. The word*Auto*will appear and the*First row* or *Last row* will revert to the default row.

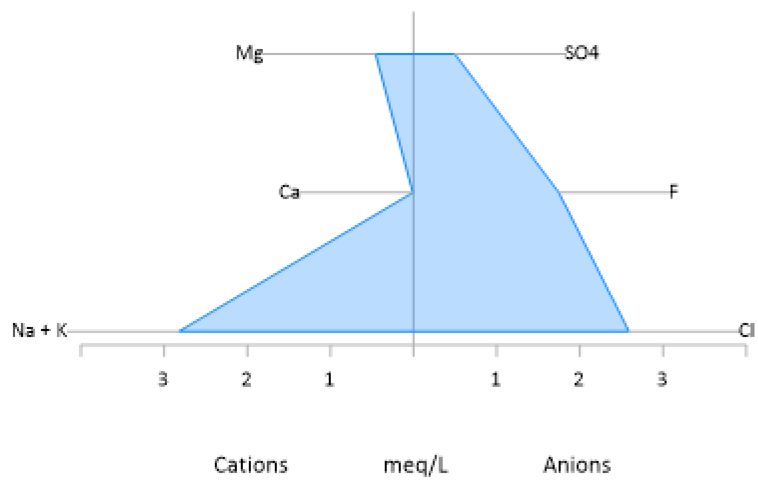
Tick Label Range

The *Tick label range* section controls the minimum and maximum tick mark value that should contain a label. Click the ⊞ next to *Tick label range* to open the section. The *Min label value* is the first value on the axis that should contain a tick label. The *Max label value* is the last value on the axis that should contain a tick label. All tick marks before the *Min label value* or after the *Max label value* do not display tick labels. These values are in axis units. To change the values, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the value.

The axis minimum and maximum are displayed in the *Min label value* and *Max label value* fields, by default. If *Auto* appears, the tick label range is automatically generated based on the axis minimum and maximum. To limit the range, you can click the word *Auto* next to *Min label value* or *Max label value* and select *Custom*. You can then enter a new value into either the *Min label value* or *Max label value* box. To change the value, highlight the existing value and type a new value. Press ENTER on the keyboard to update the axis. Click the word *Custom* and select *Auto* to go back to automatic tick label limits. The word*Auto*will appear and the*Minimum* or *Maximum* will revert to the default value.

Stiff Plot Axis Tick Label Range

The *Tick label range* values for a stiff plot axis specifies which labels will display for both the left and right sides of the stiff plot axis. The *Min label value* must be greater than or equal to 0. In the following image for example, the *Min label value* = 1 and the *Max label value* = 3. Labels are not displayed for the 0 tick mark in the center or for the tick marks at the value 4 on both the left and right side of the axis.



Tick labels are controlled by the Tick label range *properties.*

Label Value Divisor

Enter a value in the *Label value divisor*box to divide the label by the value entered. For example, this is useful when you want to display only the first two digits of a data point that is in the tens of thousands. A*Label value divisor*of 1000 would make a label of 25000 appear as 25. To change the value, highlight the existing value and type a new number. Press ENTER on the keyboard to make the change.

Label Alignment

For standard X Axes, Z Axes, and angle axes, you can set the tick label alignment to the right of the tick marks, centered on the tick mark, or to the left of the tick mark by selecting *Right, Center,* or *Left* from the *Label alignment* list. For Y Axes, you can set the tick label alignment to the top of the tick marks, centered on the tick mark, or below the tick mark by selecting *Top, Center,* or *Below* from the *Label alignment* list. To change the *Label alignment*, click on the existing option and select the new option from the list.

3D Angled Tick Mark Labels

On 3D Axes, check the box next to the *Angled* option to draw tick mark labels at the same angle as the axis. If this box is not checked, the labels are always displayed parallel to the screen, no matter how the graph is rotated.

Label Settings

The *Label Settings* section includes properties for the appearance of the labels, including font, format, background, and position. The *Label Settings* section properties can be set independently for major and minor tick labels.

Labels to Edit

The *Labels to edit* property controls which labels are being edited by the *Label Settings* properties. Select Major labels to change the major tick label properties. Select *Minor labels* to change the minor tick label properties. The *Labels to edit* field is only displayed when both major and minor tick labels are displayed on the axis.

Frequency

For linear, log base 10, or natural log standard axes and angle axes, the *Major label frequency* or *Minor label frequency* propertydetermines how many tick marks contain labels. For example, when *Major label frequency* set to 1, every major tick mark is labeled. When the *Major label frequency* is set to two, every other major tick mark is labeled. To change the *Major label frequency* or *Minor label frequency*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the value. The *Major label frequency* or *Minor label frequency* value can be any whole number between 1 and 100. To display no labels, clear the *Show major tick labels* and/or *Show minor tick labels* box.

For probability axes, you can set the major tick label *Frequency* to *Dense*, *Medium*, or *Sparse*. The *Dense* setting labels every major tick, *Medium* labels every other major tick, and *Sparse* labels every third major tick.

Axes with a log base 10 scale have minor tick label *Minor label frequency* options of *All*; at the *2, 4, 6, 8* minor ticks; at the *2, 3, 5* minor ticks; at the *2, 5* minor ticks; and at the 3 minor tick. To change the minor tick label *Minor label frequency* for log axes, click the current option and select the desired option from the list.

Label Format

The *Label Format* section includes the font, format, background and label width properties for the tick labels.

Label Font

Click the ⊞ next to *Font* to set the label font properties. The font *Face, Size (points), Color, Opacity, Bold, Italic, Underline,*and*Strikethrough*properties can be set for most labels.

Label Format

Click the ⊞ next to *Format* to set the label format properties. The label *Type,* display of numbers, *Prefix,* and *Suffix* can be set for labels.

Label Background

Click the ⊞ next to *Background* to set the label background properties. The *Background* is the area behind the label. Click the ⊞ next to *Line* to set the line properties for the line that goes around the text. Click the ⊞ next to *Fill* to set the fill properties for the area around the text.

Limit Label Width

For major labels only, you can limit the width of the label that appears. When the label reaches the maximum width, the label wraps to a second line. Check the box next to *Limit label width* to limit how wide the tick labels can be by using the *Break at spaces* and *Width*options.

Break at Spaces

For major labels only, once the *Limit label width* option is checked, you may choose to check the *Break at spaces* box to break the labels only at spaces. For example, if the labels are Jan 2009, Feb 2009, Mar 2009, etc. Then, the *Break at spaces* will start a new line at the space between the month and the year. When multiple spaces occur, the break will occur at the space nearest the *Width* value. When the *Break at spaces* box is cleared, breaks can occur in the middle of a word or number.

The Limit label width box and the Break at spaces box are checked in this example. A line break occurs at the space between the month and year.

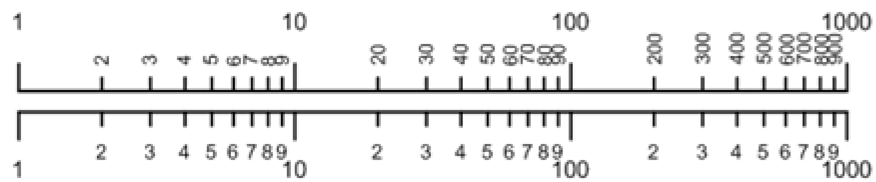
Width

For major labels only, once the *Limit label width* option is checked, you may enter a value in the *Width* box to set a maximum label width in page units. *Width* values must be between 0.05 and 5 inches (0.127 and 12.7 centimeters). Once the *Width* value is set, any label text exceeding the maximum width will wrap to the next line.

TheLimit label widthbox is checked in this example. The Widthis set to0.50 incausing a text wrap at a specific width.

Log Labels One Digit

For minor labels only, the *Log labels one digit* option is available when the axis *Scale* is set to log base 10. When the scale is set to log base 10, axis labels are displayed without zeros after the first digit when the *Log labels one digit* option is checked.



The same axis displayed with Log labels one digit *cleared on top and with* Log labels one digit *checked on bottom.*

Label Position

The *Label Position* properties specify where the labels are in relation to the axis, the offset from the axis or tick marks, and the label angle.

Label Side

The *Labels on side* option allows you to select which side of the axis to display labels. With X Axes and Z Axes, you can show labels *Above* or *Below* the axis. With Y Axes, you can show labels to the *Right* or *Left* of the axis. With angle axes, you can show the labels *Outside* or *Inside* the axis.

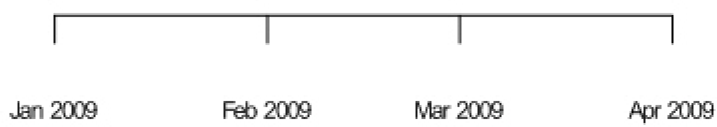
The Label Side option is Above for this X Axis label example.

The Label Side *option is* Below *for this X Axis label example.*

Offset

The *Offset* controls the distance between the tick mark and the tick label. An offset of zero places the labels so that the label is just touching the tick mark. The *Offset* value is in page units. Enter a value between -5 and 5 inches (-12.7 and 12.7 centimeters).

The Offset *is set to* 0.00 inch *in this example.*



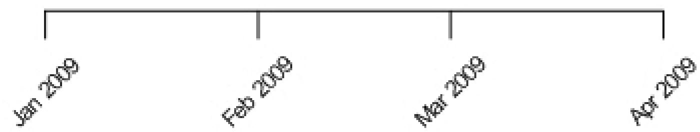
The Offset *is set to* 0.40 inch i*n this example.*

Label Orientation

Angle axes have a *Label orientation* option that controls the way labels are displayed. Setting the *Label orientation* to *Horizontal* makes all of the labels have the same horizontal rotation. Setting the *Label orientation* to *Radial* causes the labels to be drawn parallel to the ray extending from the plot origin through the label. The label is read from the angle axis outward. For example, the 45 degree label is rotated counter-clockwise 45 degrees. The 270 degree label is rotated 180 degrees and displays upside-down. To change the *Label orientation,* click on the current option and select the new option from the list.

Angle

The labels can be rotated by entering a number into the *Angle* box. Positive values rotate the labels counter-clockwise. Negative values rotate the labels clockwise. The *Angle* is listed in degrees and can be a value between -360 and 360 degrees. To change the *Angle*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the  to increase or decrease the value.

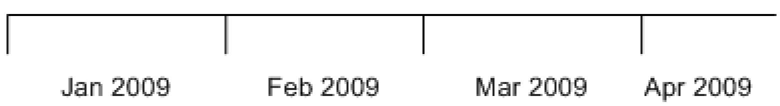


The Angle is set to 45 degrees in this example.

Between Ticks

For major labels only, the *Between ticks* option shows tick labels between the major tick marks. To display the label between the tick marks, check the box next to *Between ticks*. This option is useful when the area between tick marks should be labeled. Ticks move to the right. The last tick label is moved between the last tick mark and the end of the axis.

The Between ticks *option is not checked in this example.*



The Between ticks *option is checked in this example.*

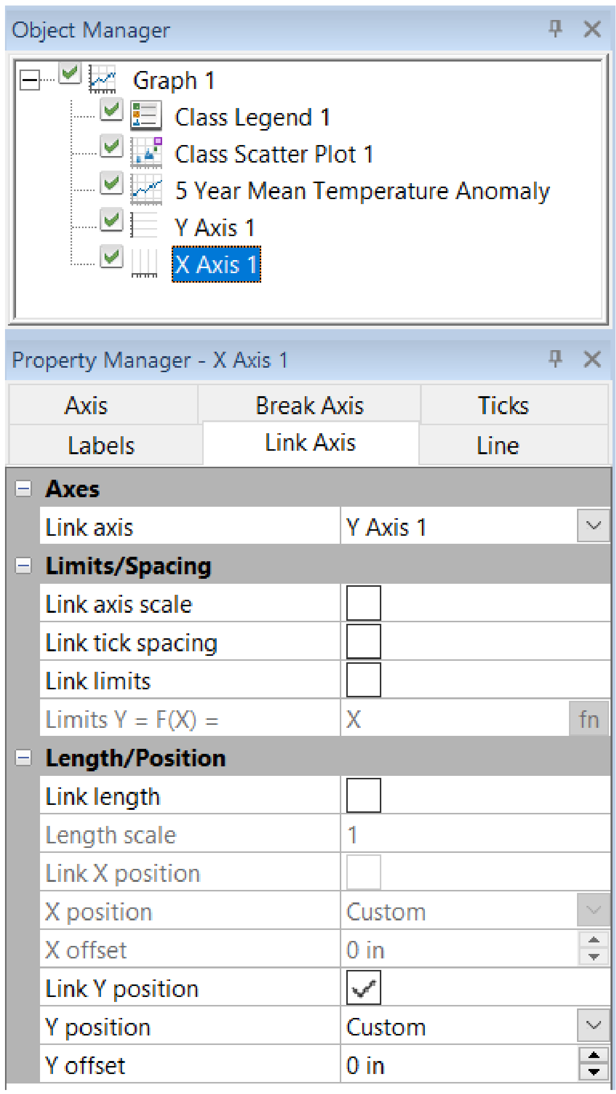
Label Line

Label lines can be used to connect the text label to the tick mark. If the labels have been moved with the **Graph Tools | Plot Tools | Move Labels** command, a line is displayed. The line goes from the label to the tick mark. Change the label leader line properties on the Line page in the **Property Manager**.

Link Axis

The **Link Axis** tab in the **Property Manager** controls how multiple axes are linked together. Linking can control the scaling, position, tick mark spacing, limits, and length of the axis. When the controlling axis is edited, all linked axes are also updated.

To link axes, at least two axes must exist in the graph. This can be an X and Y axis or it can be multiple X or multiple Y axes. Open or create a graph and select the axis to be linked to another axis. With this dependent axis selected, click on the **Link Axis** tab in the Property Manager.



Link a dependent axis to a controlling axis on the ***Link Axis*** *tab in the* ***Property Manager****.*

Link Axis

The *Link axis* option sets the controlling axis. This is the master axis that should control the selected dependent axis. Set the controlling axis (or master axis) by clicking on *None* next to the *Link axis* option and selecting the desired controlling axis from the list. Only axes from the current graph can be selected.

Link Axis Scale

Checking the *Link axis scale* box means that when the *Scale* option in the *Axis Properties* section on the Axis tab changes for the controlling axis, the linked axis also changes. For example, if the *Scale* for the controlling axis is changed from *Linear* to *Log (base 10)*, the *Scale* for all linked axes are automatically updated. To link the axis scale, check the box next to *Link axis scale* when the dependent axis is selected.

When *Link axis scale* is checked for a dependent axis, the *Scale* option on the **Axis** tab displays *Linked* in the **Property Manager**. To change the *Scale* for the dependent axis, select the controlling axis and change the *Scale*.

Link Tick Spacing

Checking the *Link tick spacing* box means that when the *Spacing* option in the *Major Ticks* section on the Tick Marks tab changes for the controlling axis, the linked axis also changes. This can mean that the major tick mark spacing is set for all axes at once. This does not control tick mark length, tick mark line properties, or the number of divisions for minor tick marks. For example if the controlling axis *Spacing* is changed to 5, all linked axes are automatically updated to a major tick mark *Spacing* of 5. To link the axis tick mark spacing, check the box next to *Link tick spacing* when the dependent axis is selected.

When *Link tick spacing* is checked for a dependent axis, the *Spacing* option on the **Ticks** tab displays *Linked* in the **Property Manager**. To change the *Spacing* for the dependent axis, select the controlling axis and change the *Spacing*.

Link Limits

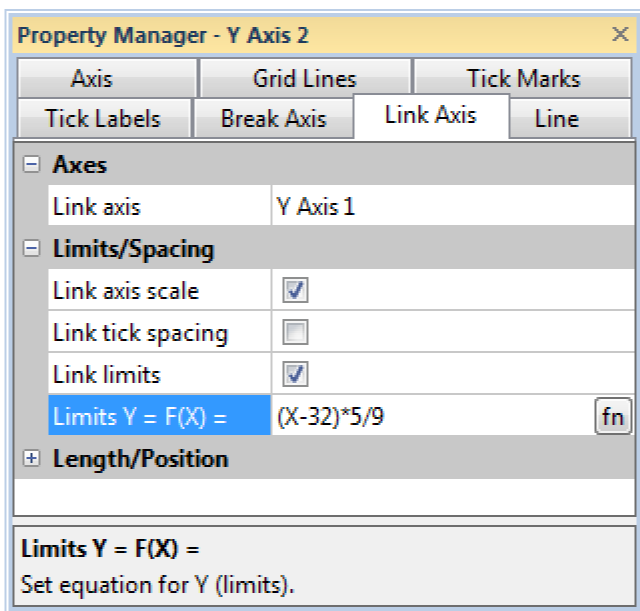
Checking the *Link limits* box means that when the *Minimum* or *Maximum* option in the *Limits* section on the Axis tab changes for the controlling axis, the linked axis also changes. This means that the starting and ending values are automatically calculated based on the controlling axis. When plot data changes or the controlling axis *Minimum* or *Maximum* changes, all linked axes also change. For example if the controlling axis *Minimum* value is changed to 15, all linked axes are automatically updated to a *Minimum* value of 15. To link the axis limits, check the box next to *Link limits* when the dependent axis is selected.

When *Link limits* is checked for a dependent axis, the *Minimum* and *Maximum* options in the *Limits* section on the **Axis** tab displays *Linked* in the **Property Manager**. To change the *Minimum* or *Maximum* for the dependent axis, select the controlling axis and change the *Minimum* or *Maximum*.

Limits Equation

When the *Link limits* box is checked, the *Limits Y = F(X) =* option becomes available. This option allows an equation to be input for the linked axis, if desired. For instance, if the controlling *Y Axis* displays degrees Fahrenheit and the linked axis should display degrees Celsius, the equation to enter is (X-32)*5/9. The X refers to the controlling axis. The equation is always input so that the dependent axis scale is calculated using the controlling axis. Click the fn button to select from a variety of functions, if needed. The linked axis cannot have an inverse relationship to the controlling axis, for example any functions of the form *1/X*.

Click here for common equations used in Grapher.

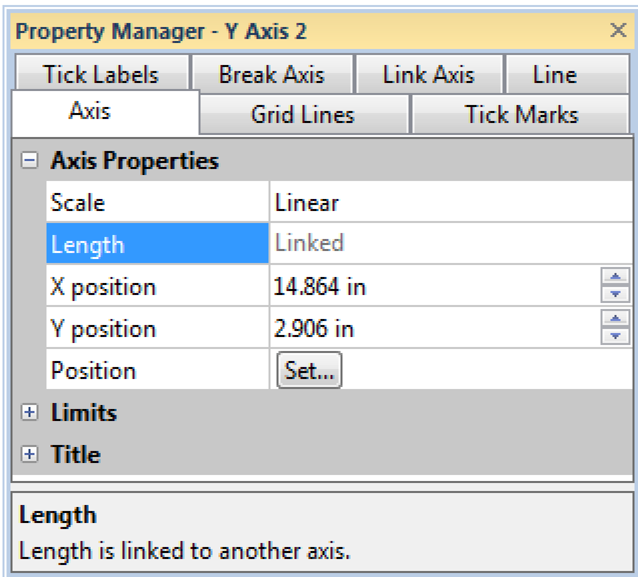


This example displays a degrees Celsius axis being linked to a degrees Fahrenheit axis. As the controlling Fahrenheit axis changes limits, the dependent Celsius axis will automatically update the limits based on the equation entered.

Link Length

Checking the *Link length* box means that when the *Length* option in the *Axis Properties* section on the Axis tab changes for the controlling axis, the linked axis also changes length. This means that the length of the axis is set by the controlling axis. For example, if the controlling axis is changed to 2 inches long, all linked axes also automatically change to 2 inches long. To link the axis length, check the box next to *Link length* when the dependent axis is selected.

When *Link length* is checked for a dependent axis, the *Length* option in the *Axis Properties* section on the **Axis** tab displays *Linked* in the **Property Manager**. To change the *Length* for the dependent axis, select the controlling axis and change the *Length*.

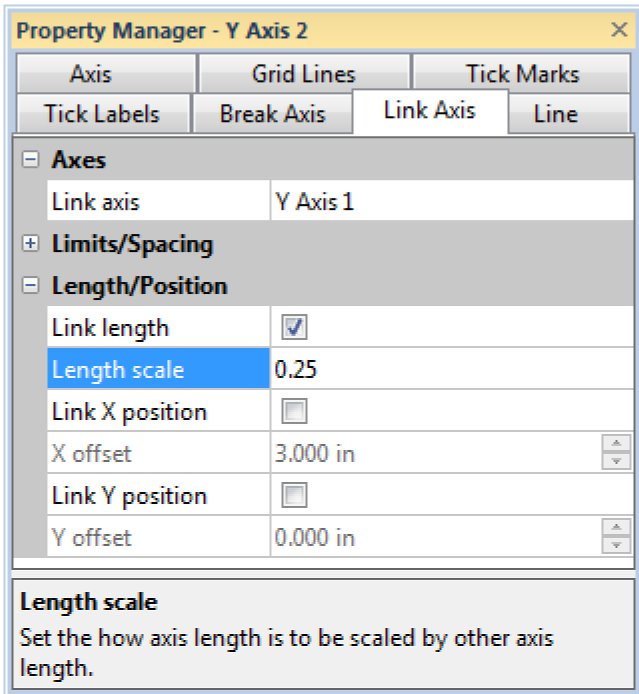


When the Link length *box is checked, the axis shows* Linked *next to* Length *on the* ***Axis*** *tab. Length changes must be made to the controlling axis.*

Length Scale

When the *Link length* box is checked, the *Length scale* option becomes available. This option allows a multiplying scaling value to be input for the linked axis, if desired. By default, the *Length scale* is set to 1. This means that the linked axis is exactly the same length as the controlling axis. To change the value, highlight the existing 1 and type the desired value. To make the linked axis twice as long as the controlling axis, set the *Length scale* to 2. If the controlling axis is 2 inches long, the linked axis will be 4 inches long. To make the linked axis half as long as the controlling axis, set the *Length scale* to 0.5. If the controlling axis is 2 inches long, the linked axis will be 1 inch long.

To change the *Length scale* option, highlight the existing value and type a new value.

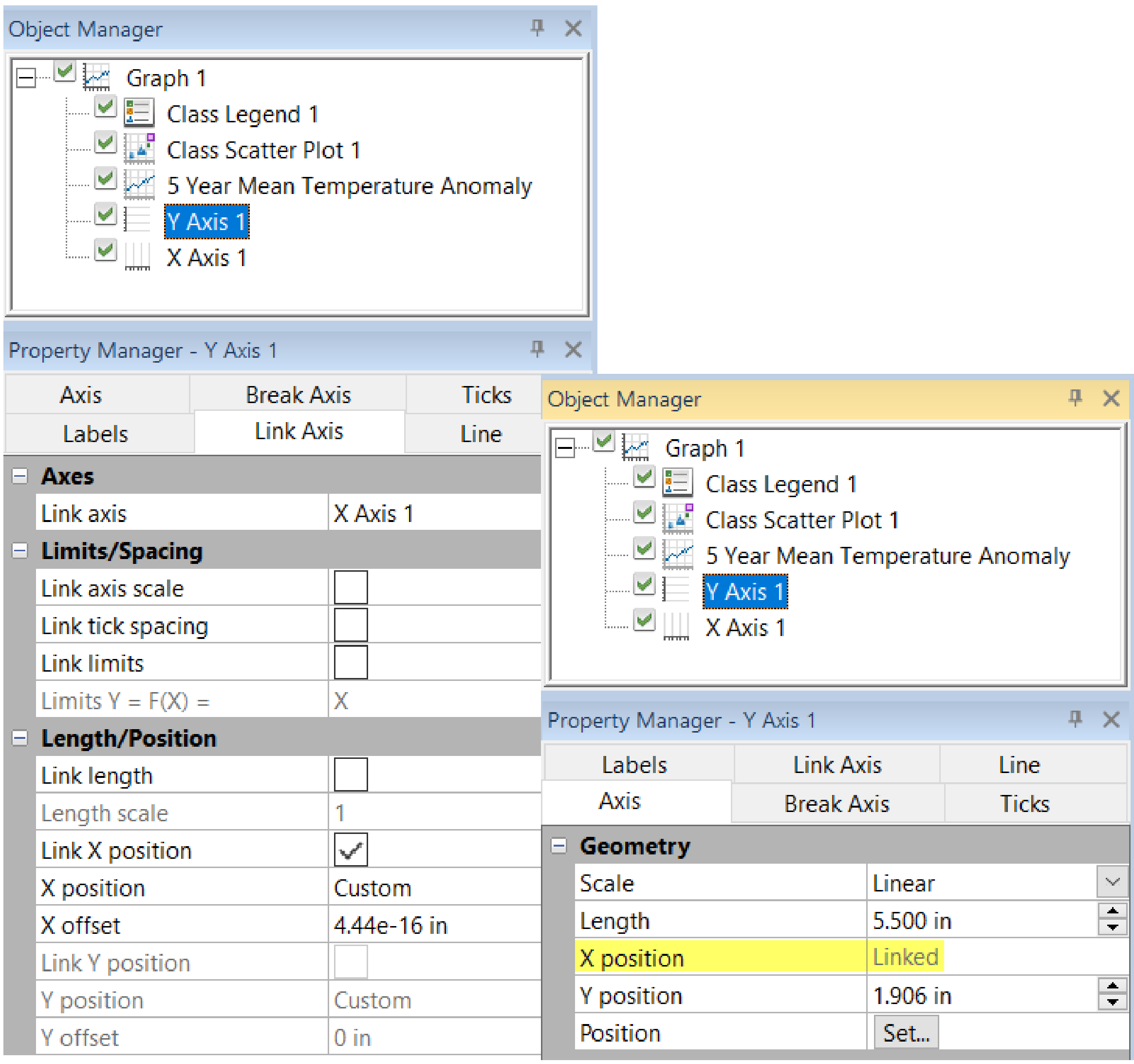


In this example, the linked axis will automatically be 1/4th the size of the controlling axis. If the controlling axis Length *is changed, the linked axis will automatically update to stay 1/4th the size.*

Link X Position

Checking the *Link X position* box means that when *X position* option in the *Axis Properties* section on the Axis tab changes for the controlling axis, the linked axis *X position* is also changed. This means that the X position of the axis is set by the controlling axis. Moving the controlling axis left or right on the page also moves the linked axis the same distance left or right on the page. For example, if the controlling axis is moved 2 inches to the left, all linked axes also automatically move 2 inches to the left. To link the axis X position, check the box next to *Link X position* when the dependent axis is selected.

When *Link X position* is checked for a dependent axis, the *X position* option in the *Axis Properties* section on the **Axis** tab displays *Linked* in the **Property Manager**. To change the *X position* for the dependent axis, select the controlling axis and change the *X position*.



When the Link X position *box is checked, the axis shows* Linked *next to* X position *on the **Axis** tab. Position changes must be made to the controlling axis.*

X Position

After checking the *Link X position* option, the *X position* becomes available to reposition the x-axis relative to the controlling axis. From the down arrow, the options are most commonly *Left of link axis*, *Right of link axis*, and *Custom.* and sometimes *None*. The default varies depending on which axis is the controlling axis and what kind of axis is being linked to the controlling axis.

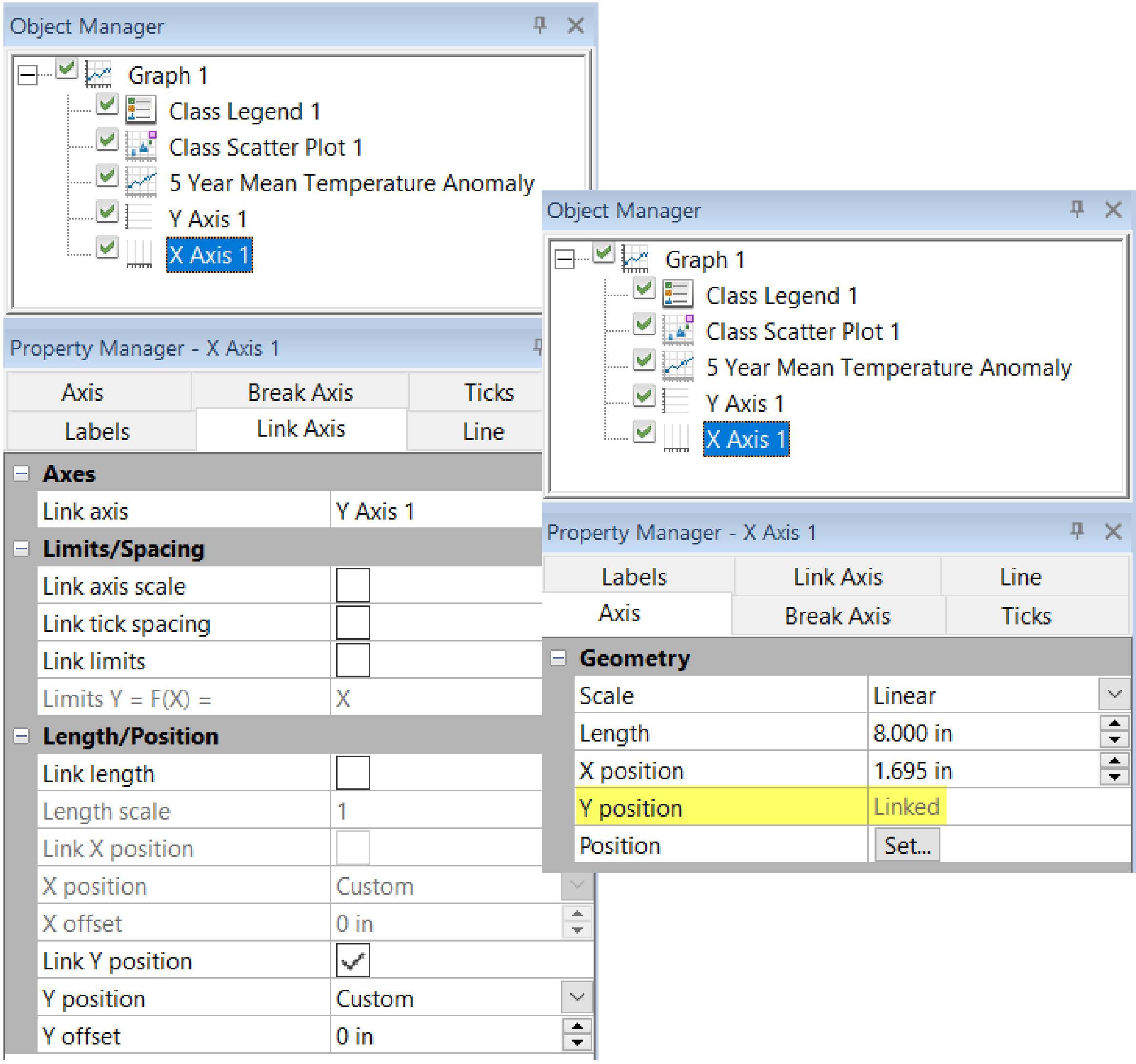
X Offset

After checking the *Link X position* option AND if the *X position* is set to *Custom*, the *X offset* becomes available. This allows a page distance to be input for the linked axis, if desired. To change the value, highlight the existing value and type a new value. The *X offset* sets the linked axis the specified number of page units away from the controlling axis horizontally. Positive values move the linked axis to the right and negative values move the linked axis to the right of the controlling axis. If the axes should be directly on top of each other, set the *X offset* to 0.

Link Y Position

Checking the *Link Y position* box means that when *Y position* option in the *Axis Properties* section on the Axis tab changes for the controlling axis, the linked axis *Y position* is also changed. This means that the Y position of the axis is set by the controlling axis. So, moving the controlling axis up or down on the page also moves the linked axis the same distance up or down on the page. For example, if the controlling axis is moved 2 inches up, all linked axes also automatically move 2 inches up. To link the axis Y position, check the box next to *Link Y position* when the dependent axis is selected.

When *Link Y position* is checked for a dependent axis, the *Y position* option in the *Axis Properties* section on the **Axis** tab displays *Linked* in the **Property Manager**. To change the *Y position* for the dependent axis, select the controlling axis and change the *Y position*.



When the Link Y position *box is checked, the axis shows* Linked*next to* Y position *on the **Axis** tab. Axis position changes must be made to the controlling axis.*

Y Position

After checking the *Link Y position* option, the *Y position* becomes available to reposition the y-axis relative to the controlling axis. From the down arrow, the options are *Top of link axis*, *Bottom of link axis*, and *Custom.*. The default varies depending on which axis is the controlling axis and what kind of axis is being linked to the controlling axis.

Y Offset

After checking the *Link Y position* option AND if the *Y position* is set to *Custom*, the *Y offset* becomes available. This allows a page distance to be input for the linked axis, if desired. To change the value, highlight the existing value and type a new value. The *Y offset* sets the linked axis the specified number of page units away from the controlling axis vertically. Positive values move the linked axis up and negative values move the linked axis down from the controlling axis. If the axes should be directly on top of each other, set the *Y offset* to 0.

Link the Z Axis

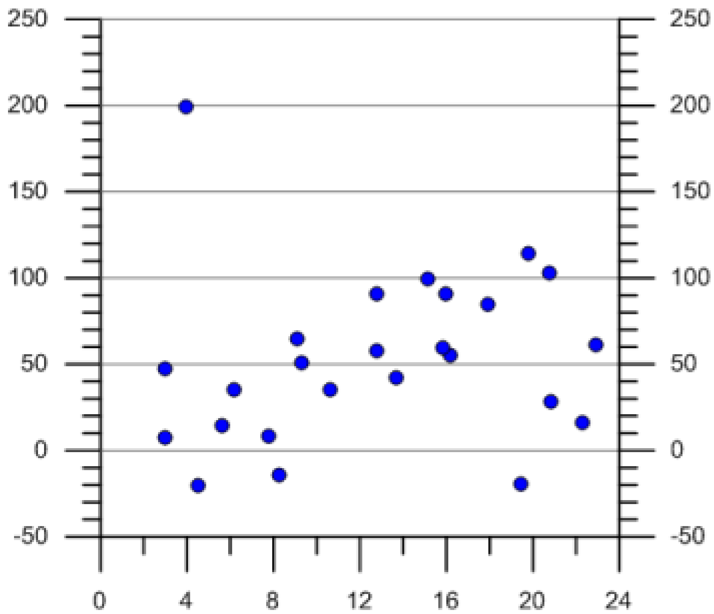
Which X position and Y position values are available depend on which axis is the controlling axis and which axes are being linked.

Example - Duplicate Axis

One common graph presentation is a single plot with a repeated vertical axis. When the plot changes only one axis automatically updates because the plot's data is displayed only using one axis. With axis linking, now the other axis can also update automatically. By default, duplicate axes have linked scales, tick mark spacing, length, and limits.

To create a duplicate axis:

1. Click on the controlling axis to select it.
2. Click the Graph Tools | Add to Graph | Duplicate Axis command.
3. In the Position Axis dialog,
    1. Set the location for the new axis. For instance, you can select *At the right of.*
    2. Set any other options, such as checking the *Flip tick marks and labels*.
    3. Click *OK*.
4. The axis is added to the graph and automatically has the scale, tick mark spacing, length, and limits linked to the original axis.



The duplicate axis on the right side of the graph will automatically change when any properties of the Y axis on the left side of the graph change.

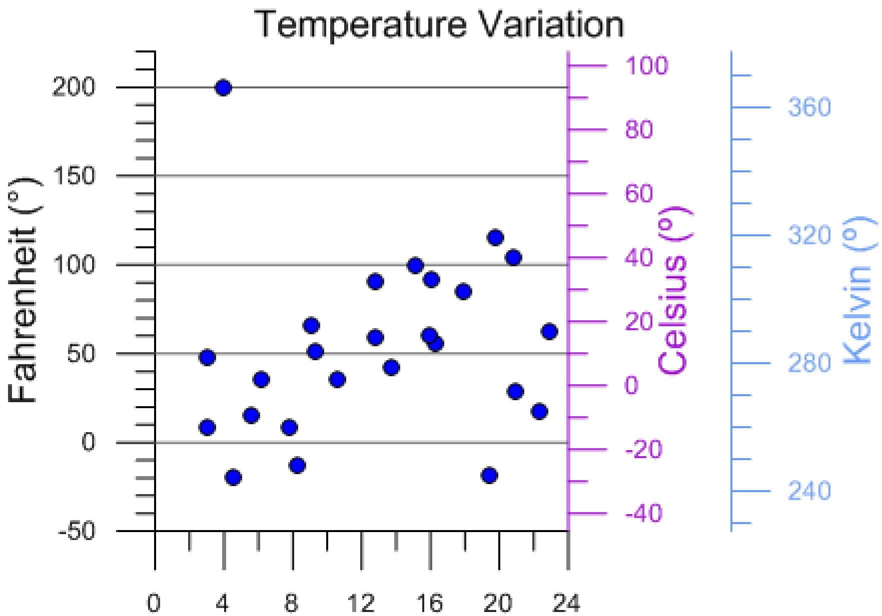
Example - Multiple Axes with Different Limits

Another common graph presentation is a single plot with multiple vertical axes with different limits. When the plot changes only one axis automatically updates because the plot's data is displayed only using one axis. With axis linking, now the other axis can also update automatically. The axis can be added with the **Graph Tools | Add to Graph | Duplicate Axis** command, as below, or with the **Home | Add to Graph | Axis** command.

To create a linked axis with different limits:

1. Click on the controlling axis to select it.
2. Click the Graph Tools | Add to Graph | Duplicate Axis command.
3. In the Position Axis dialog,
    1. Set the location for the new axis. For instance, you can select *At the right of.*
    2. Set any other options, such as checking the *Flip tick marks and labels*.
    3. Click *OK*.
4. The axis is added to the graph and automatically has the scale, tick mark spacing, length, and limits linked to the original axis. Click on the axis to select it.
5. In the **Property Manager**, click on the **Link Axis** tab.

6. Highlight the *X* next to the *Limits Y = F(X) =* and type *(X-32)*5/9*. Press ENTER on the keyboard to make the change.
7. The axis limits automatically update to be based on the controlling axis, but are calculated based on the input equation.



This example shows two dependent axes on the right side of the graph. As the properties of the plot or the Fahrenheit (°) *axis on the left side of the graph change, the* Celsius (°) *and* Kelvin (°) *axes automatically change based on the linked limits equation.*

Date Time Labels

Date/Time Formatting

In addition to numbers and text, dates and times are format types in **Grapher**. Dates and times can be used to create a graph, as axis and plot labels, to clip the graph, and to set axis limits.

Using Date/Time Formatting

To use dates and times in **Grapher**, the data need to be formatted as dates and times. One way to format data in **Grapher** is to use the worksheet. The worksheet can be accessed with the File | New | Worksheet, File | Open, Graph Tools | Worksheet | Display, and through the Worksheet Manager. Highlight the column containing dates and times and then select Data Tools | Format | Format Cells to set the column as date/time in the worksheet.

Once the formatting is set to date/time, you can use the date/time information just as you would use numbers in **Grapher**:

- you can plot the data using date/time without converting the dates and times into serial numbers
- you can set the axis limits using dates and times
- you can set plot clipping using dates and times

Date/time information can also be used as plot labels and tick labels.

Date/Time Formatting Tips

- In the worksheet, save data files containing date/time formatting as Excel files to preserve the date time formatting as seen in the worksheet.
- You can save date/time-formatted data files as ASCII files (.DAT, .CSV, .TXT, .BNA, or BLN). Sometimes this is necessary if you exceed the Excel row or column limits. When opening the file in **Grapher's** worksheet, you can make the serial numbers appear as dates by using **Data Tools | Format | Format Cells**.
- If you have formatted the data as date/time in another spreadsheet program such as Excel, the data are formatted as date/time in **Grapher**.
- Whenever possible, enter and display dates and times in one of the many calendar formats, e.g., "6/14/2009" or "14-June-2009", and let the software handle converting to/from internal numeric representations.
- When the recognized format is ambiguous (i.e. 10/7/12), the month, day, and year order is determined by the Windows locale. In some countries, this will be recognized as M/d/yy, in others as d/M/yy, and in others as YY/M/d. It is important to use non-ambiguous date/time formats when the Windows locale may change.
- If dates/times occur before 1/1/0000, use the BC or BCE suffix after the date. So, Alexander III of Macedon's birthday would be listed as 20-July-356 BCE in the worksheet. Using AD or CE is not necessary and the worksheet will automatically remove these in dates after 1/1/0000.
- The year 0 is defined, according to the ISO 8601:2004 standard.
- When a two digit year is input in the worksheet (00 to 99), it means the year in the current century. For instance, inputting 11/4/13, indicates that the year is 2013, not 0013. In order to have the year 0013, the full four digits (0013) must be input for the date. So, the date would be input as 11/4/0013 CE for November 4, 0013 CE or 11/4/0013 BCE for November 4, 0013 BCE.
- If the data is not displaying like you have specified in the **Label**

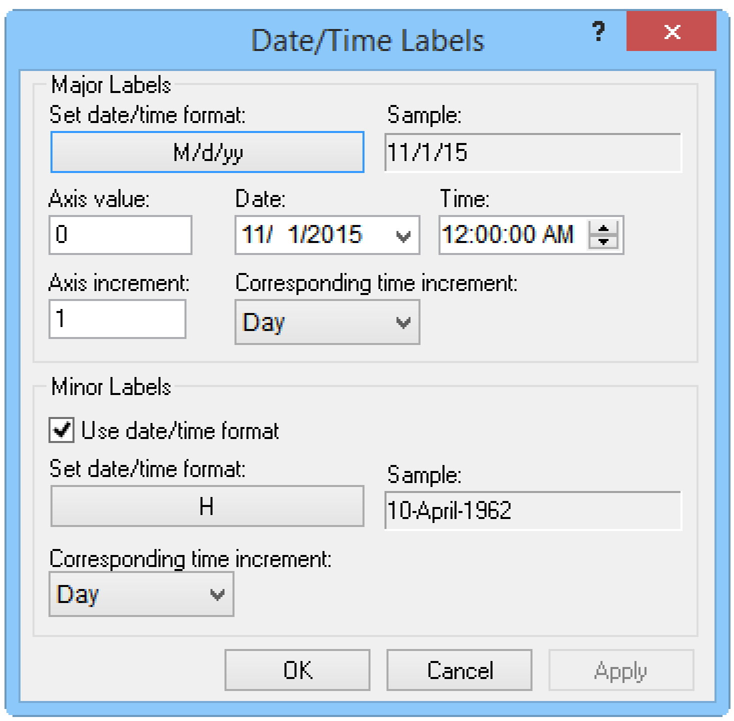
Format dialog, check the *Use Data/Time Format* box in the *Major Label Text* section of the axes properties Tick Labels page.

- When inputting date/time values in the Property Manager, date/-times must always be entered as MM/dd/yyyy hh:mm:ss. No other formats are permitted in the date/time edit boxes in the **Property Manager.**

Date/Time Labels

This section does **NOT** apply to date/time-formatted data in worksheet columns. If you are using data in a worksheet that is already formatted as dates and times, change the *Label source* to *Automatic* and check the *Use date/time format* option.

If you have evenly spaced numeric data that you would like to represent as date and time, set the *Label source* to *Numeric date/time* on the Labels tab in the *General* section. Click the *Set* button next to *Date/time settings* to open the **Date/Time Labels** dialog.



*Use the **Date/Time Labels** dialog to customize date/time labels.*

Format

The format displayed under *Set date/time format* is the format that you want the label to display. Click the current format to select or create a date/time format in the Date/Time Format Builder dialog.

Sample

A sample of the selected format appears in the *Sample* box.

Axis Value and Corresponding Date/Time

The *Axis value* is the numeric value in the worksheet that equals a specific date and time. If a numeric data column is used to create the graph, enter the data value that equals the corresponding time label. Use a row number if the row number or sequence number options are used to create the graph. To change the *Axis value*, highlight the existing value and type a new value.

Select the *Date* and *Time* of the *Axis value* in the boxes to the right of the *Axis value*. To change the *Date*, highlight an existing value and type a new value. Alternatively, click the to show a calendar. Click the appropriate day on the calendar. To change the *Time,* highlight the existing value and type a new value. Alternatively, click the to scroll to a new time.

Axis Increment

The *Axis increment* is the number of data units in a specified time unit. Make sure the tick mark spacing is appropriate for the axis increment setting. To change the *Axis increment*, highlight the existing value and type a new value.

Corresponding Time Increment

The *Corresponding time increment* is the unit of time applied to the *Axis increment* value. To change the *Corresponding time increment*, click on the existing option. In the list, select the new option. Select *Year, Month, Week, Day, Hour, Minute,* or *Second*.

Minor Labels

Check the box next to the *Use date/time format* command in the *Minor Labels* section to use date/time formatting for both the major labels and minor labels. If this option is not checked, the minor labels will show only numbers.

Check the box next to the *Auto select time increment* to allow **Grapher** to determine automatically the interval for the minor labels. When this box is unchecked, you can set the *Corresponding time increment.*

Select the *Format* of the minor label from the format list. This is the format that you want the minor labels to display.

Select the *Corresponding time increment* from the list. This is the increment to display minor labels.

OK, Cancel, and Apply

Click the *OK* button to make the changes and close the **Date/Time Labels** dialog. Click *Cancel* to return to the plot window without making the changes. Click *Apply* to make the changes and keep the dialog open. This allows you to see the changes you have made and make additional changes before closing the dialog.

Example

An observation is recorded once a day for 21 days. The data are plotted using the row number for X and the observation value for Y. The first row contains headers and the data begins on row 2. The following steps show how to plot month-day-year labels on the X Axis for each data point.

1. Select the X Axis by clicking on it in the Object Manager or plot window.
2. Click on the Ticks tab in the Property Manager and set the major tick mark *Spacing* to 1.
3. Click on the Labels tab in the Property Manager and set the major tick label *Angle* to 90.
4. In the *General* section, change the *Label source* to *Numeric date/-time*.
5. Click the *Set*button next to the *Date/time settings* option to open the **Date/Time Labels** dialog.
6. In the **Date/Time Labels** dialog, click the current date time format under *Set date/time format*. The **Date/Time Format Builder** dialog opens.
7. In the **Date/Time Format Builder** dialog, select MMMM dd, yyyy from the *Predefined date/time formats* list.
8. Click the *Insert* button next to the MMMM dd, yyyy format. The *Date/Time format (edit to change)* field is updated with the selected format.
9. Click *OK* in the **Date/Time Format Builder** dialog.
10. Since the data begin on row 2 (headers are in row 1), the axis minimum is two. Set the *Axis value* to 2.
11. The first day of the observations is January 15, 2011, so set the *Date* to 1/15/2011. You can enter the month, day, and year or you can

select the date from a calendar by clicking the down arrow to the right of the date. Set the hours, minutes, and seconds to 12:00:00 AM to set the time to midnight.

12. Set the *Axis increment* to 1 since there is an observation once a day. Each row is a new observation and increases by a value of 1.
13. Set the *Corresponding time increment* to *Day* because each new row is a new day. The increment 1 is now linked to a day.
14. Click the *OK* button to save your changes and close the **Date/Time Labels** dialog.

The axis labels appear once a day with dates beginning at January 15, 2011 and ending on February 4, 2011.

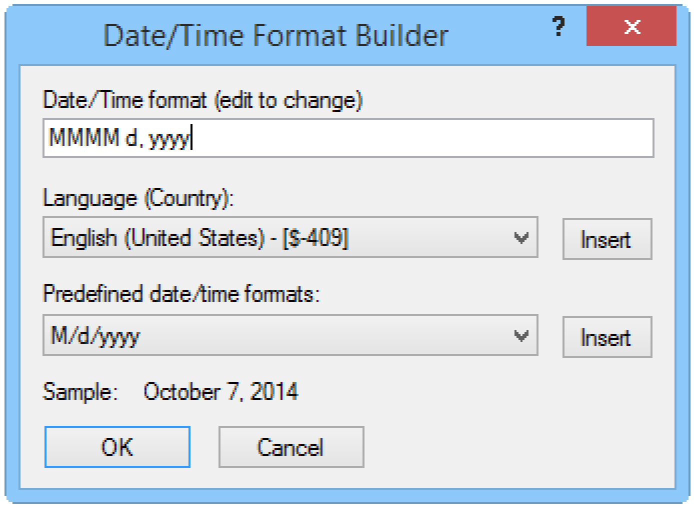
Tips About Date/Time Labels

There are three ways to show date/time tick mark labels in **Grapher**, depending on your data:

- If you have evenly spaced numeric data that you would like to represent as time, you can select *Numeric date/time* as the *Label source* in the axis properties Labels section as described above.
- If the time increments are unevenly spaced, change the *Label source* to *From worksheet* to generate date/time labels. The labels must appear in the worksheet in the format that you wish to see on the graph.
- If the data are already in a date/time format in the worksheet, set the *Label source* to Automatic and check the *Use date/time format* option.

Date/Time Format Builder Dialog

In the Text Editor dialog, click the button to open the **Date/Time Format Builder** dialog. From the worksheet, click the button in the Format Cells dialog Number page. The **Date/Time Format Builder** dialog is also accessed by clicking the *Select* button in the *Date/time format* field in the Label Format section of the **Property Manager** and clicking a format in the Date/Time Labels dialog. When the **Date/Time Format Builder** is used to insert date/time math text instruction with the Text Editor, the date/time will update every time the project updates.



*The **Date/Time Format Builder** dialog is used to insert or create date/time formats for worksheet cells or text objects.*

Date/Time Format

Type a Date/Time Format into the *Date/Time format (edit to change)* field to set the date/time format. You can also use the *Language (Country)* and *Predefined date/time formats* lists to insert multiple date/time formats and languages.

Language (Country)

By default, the program will use the computer's default language settings for displaying the date/time options in the worksheet. The computer default is controlled by the Windows Control Panel. Refer to your Windows documentation for information about setting the locale. The *Language (Country)* uses the same codes to override the display. For instance, if the date/time values should always be displayed in English, regardless of locale, you could select *English (United States) - [$-409]* and click the *Insert* button. Insert the locale setting first in the *Date/Time format* box. Any cells with the specified language will appear in that language. In addition, the options in the *Predefined date/time formats* will change to show the common formats for that locale. Locale IDs are input as [$-####] in the *Date/Time format* field, where the #### is the locale identifier.

Note: The *Insert* button must be clicked after selecting the *Language (Country)* option. Simply selecting the *Language (Country)* does not change the *Date/Time format*. The *Date/Time format* does not change until *Insert* is clicked.

Predefined Date/Time Formats

The *Predefined date/time formats* list contains the common formats for the selected *Language (Country)* option or for your Windows locale. Available formats are made of combinations of year, month, day, hours, minutes, seconds, and AM/PM designation. Years are shown as yy or yyyy. Months are shown as M, MM, MMM, MMMM, or MMMMM. Days are shown as d, dd, ddd, or dddd. Hours are shown as h, hh, H, HH, or [h]. Minutes are shown as m, mm, or [mm]. Seconds are shown as ss, ss.0, ss.00, ss.000, ss.0000, or [ss]. AM/PM designation is shown as tt or TT. BC/AD designation is shown as gg or GG. BCE/CE designation is shown as g, G, ggg, or GGG. Refer to formats for information about each specific option.

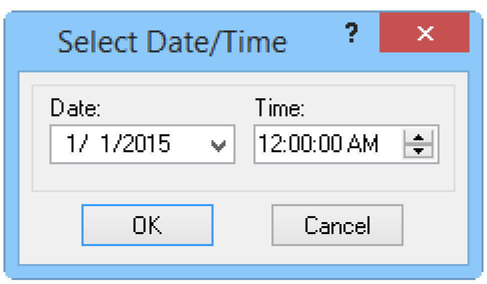
Note: The *Insert* button must be clicked after selecting the *Predefined date/time formats* option. Simply selecting the *Predefined date/time formats* does not change the *Date/Time format*. The *Date/Time format* does not change until *Insert* is clicked.

Sample

The *Sample* text updates to show a sample of the current entry in the *Date/Time format (edit to change)* field.

Select Date/Time

The **Select Date/Time** dialog is available when using date/time formatted data. You can set axis limits and clipping with date and times through the **Select Date/Time** dialog.



*The **Select Date/Time** dialog allows clipping or axis limits based on a date and time.*

To open the **Select Date/Time** dialog for axis labels,

1. Click on an axis to select it.
2. Click on the Axis tab in the Property Manager.
3. Click the ⊞ next to the *Axis limits* to open the *Axis limits* section.

4. Click the current *Minimum date/time* or *Maximum date/time* to open the **Select Date/Time** dialog.

To open the **Select Date/Time** dialog when clipping a plot,

1. Click on a plot to select it.
2. Click on the Clipping tab in the Property Manager.
3. Click the current *X minimum date/time*, *X maximum date/time*, *Y minimum date/time*, or *Y maximum date/time* to open the **Select Date/Time** dialog.

To change the date or time in the **Select Date/Time** dialog,

1. Click on the current *Date* or *Time* value.
2. Type a new value.
3. Click *OK* and the *Date* and *Time* are updated in the **Property Manager**.

Alternatively,

1. Click the next to the existing *Date*.
2. In the calendar that is displayed, select a new date.
3. Highlight the hour, minute, second, or AM/PM designation.
4. Click the next to the existing *Time* to increase or decrease the selected value.
5. Click *OK* and the *Date* and *Time* are updated in the **Property Manager**.

Worksheet Labels

Display text or symbol labels in **Grapher** using worksheet labels. The labels and tick marks are entered into a data file and used as major tick mark labels on the specified axis.

Setting up the Data File

Using text labels from a data file requires two columns of information. These columns can be contained in the data file used to create the graph or they can be included in a separate data file.

One of the columns needs to contain tick mark locations. The tick mark locations do not need to be evenly spaced, though they must use the same data units and in the same general range as the data used for the axis. The tick mark locations can be the same information as the X or Y data, although this is not necessary.

The second column contains the text for the axis labels. Any text that can be entered into the worksheet can be displayed on an axis. Match the label column to the appropriate data in the tick mark column to display the labels on the appropriate tick marks. To plot symbols in labels, use Math Text.

Example 1

A data file contains temperature with a range of 26 to 68 degrees Fahrenheit. The tick mark labels should be displayed with degree symbols (26°F). The data are dense enough that displaying a tick mark for each data point would cause the labels to overlap. Therefore, the tick marks are displayed in custom locations using the *From worksheet* option.

The tick mark and label columns would appear like this:

Tick Mark Locations	**Labels**
20	20\f"Symbol" \a176 \f"Arial" F
30	30\f"Symbol" \a176 \f"Arial" F
40	40\f"Symbol" \a176 \f"Arial" F
50	50\f"Symbol" \a176 \f"Arial" F
60	60\f"Symbol" \a176 \f"Arial" F
70	70\f"Symbol" \a176 \f"Arial" F

The \f"Symbol" \a176 \f"Arial" F in the labels column are math text directions for the degree symbol plus the letter F.

To create custom tick marks and labels with symbols:

1. Select an axis.
2. Click on the Labels tab in the Property Manager.
3. In the *General* section, select *From worksheet* as the *Label source*.
4. Select a worksheet from the *Worksheet* list or click the *Browse* option to open the **Open Worksheet** dialog to select a data file. Click the *Open* button once you have selected the data file.
5. Set the *Data column* to the column containing the tick mark locations.

- Selecting the *Row number* option plots the axis with the row numbers used in the *Worksheet rows* group on the graph properties plot page. For example, if the first row is number two, the axis begins at two.
- The *Sequence number* option plots the data according to the total number of rows used. The sequence number always begins with number one no matter which rows are selected in the *Worksheet rows* group on the graph properties plot page.

6. In the *General* section, set the *Label column* to the column containing the tick labels.
7. In the *Worksheet rows* section, set the *First row* and *Last row* as needed to limit the tick labels.

Example 2

Axis labels can be added to specific locations on the axis and with unique text by using worksheet axis labels.

To add custom axis labels to the graph:

1. Type the data values of the axis labels into a column in a data file. For example, to place labels at axis values three, seven, nine, and twelve, enter 3, 7, 9, and 12 into an empty data column. This data file does not need to be the same data file used to create the graph.
2. In another column, type the label to be displayed for each axis value. The label should be on the same row as the axis value. Your worksheet may look like:

	A	B
1	3	Label A
2	7	Group B
3	9	Unit C
4	12	Section D

The Data value is in column A.

The label is in column B.

3. In the plot window or **Object Manager**, click on the axis to select it.
4. In the **Property Manager**, click on the **Labels** tab.
5. In the *General* section, set the *Label source* to *From worksheet.*
6. Click the word *None* next to the *Worksheet* field to select the worksheet containing the labels. A list appears from which you can select an existing worksheet to open. Alternatively, you can choose the *Browse* option to open the **Open Worksheet** dialog and select a different worksheet file. Click the *Open* button to exit the **Open Worksheet** dialog.

7. In the *Worksheet rows* section, set the *First row* and *Last row,* if necessary. For instance, if you only want to display the labels at 3, 7, and 9, you could set the *Last row* to row 3.
8. Set the *Data column* to the column that contains the actual axis data values. In the example worksheet above, this is Column A.
9. Set the *Label column* to the column that contains the label to be displayed. In the example worksheet above, this is Column B.
10. Set any additional tick label properties.

The tick labels are automatically updated on the axis.

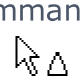
The axis is displayed with tick marks set by the Data column value and tick labels set by the Label column text.

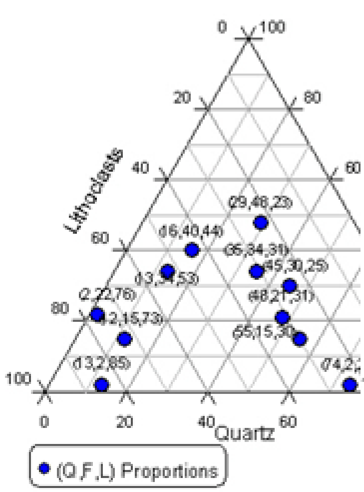
Ternary Axes Tips

Ternary axes are based on the standard axis. However, there are some differences in ternary axes. Ternary axes must always go between 0 and 100 or 0 and 1. Limits are set by drawing a triangle onto the existing ternary diagram or through a Limits dialog.

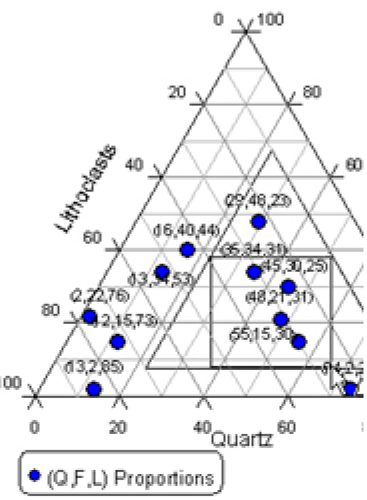
Below are some tips when working with ternary diagram axes:

- The *Axis Limits* section includes the *0 to 100 scale, Reverse direction, Limits,* and *Advanced* options.
- The *0 to 100 scale* check box changes the axis range from 0 - 1 to 0 - 100. Enabling this option for one axis automatically changes it for all three ternary axes.
- The *Reverse direction* option changes the direction of all three ternary axes.

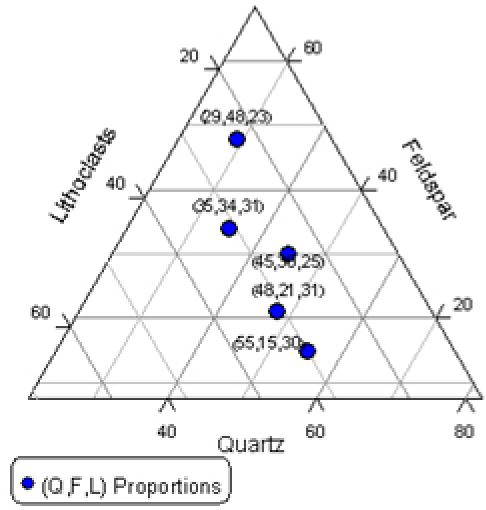
Click the *Select* button next to the *Limits* command to specify new axis limits with the cursor. The cursor changes to . Left-click and drag a selection area on the current ternary plot. The plot will update with the new axes limits.



The original Ternary Plot.



Left-click and drag the cursor to select the area of the new axis limits. The triangle drawn displays what the new axis limits will be.

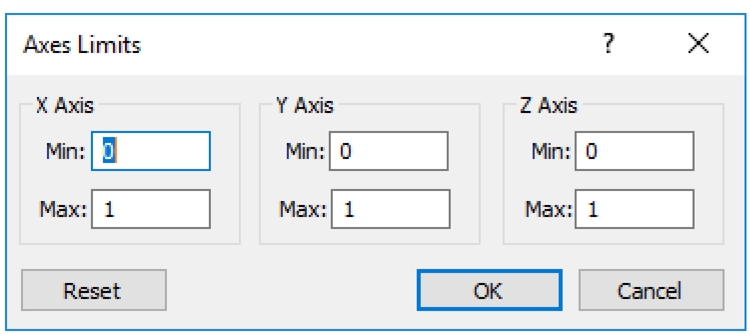


Release the left mouse button to change the axis limits to the selected triangle area.

- Click the *Enter limits* button next to the *Advanced* command to open the Axis Limits dialog.
- The scale is always *Linear* on ternary axes.
- Moving one ternary axis moves all three ternary axes.
- The *Position* field is not available with ternary axes.

Axes Limits Dialog

Ternary Plots have *Advanced* axis limits properties. Click the *Enter Limits* button next to *Advanced* in the *Limits* section of the Ternary Plot Axis Properties.



*Use the **Axes Limits** dialog to limit the ternary plot axis.*

Axis Limits

Type the *Min* and *Max* values for the *X Axis*, *Y Axis*, and *Z Axis.* The axis limits must satisfy three conditions:

- XMax + YMin + ZMin = 1
- XMin + YMax + ZMin = 1
- XMin + YMin + ZMax = 1

Reset

Click the *Reset* button to set all three axes to the default *Min* of 0 and default *Max* of 1.

OK

Click the *OK* button to close the dialog and save the changes.

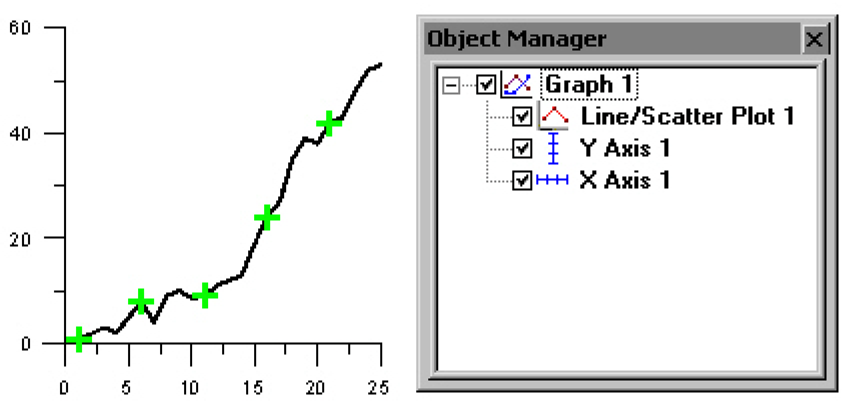
Cancel

Click the *Cancel* button to close the dialog without saving the changes.

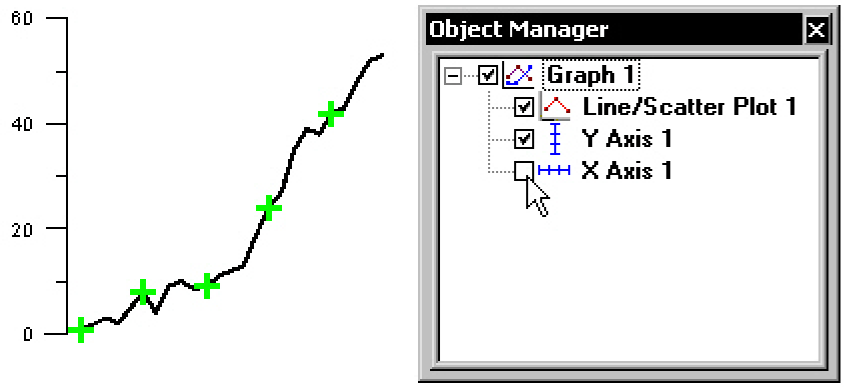
Hiding Axes

To hide an axis, turn the display of the axis off:

1. Open the Object Manager.
2. Uncheck the box to the left of the axis name.



In this example, the X Axis and Y Axis are visible and have check marks in the visibility box in the ***Object Manager****.*



*In this example, the Y Axis is visible, but the X Axis is not visible, and has no check mark in the visibility box in the **Object Manager**.*

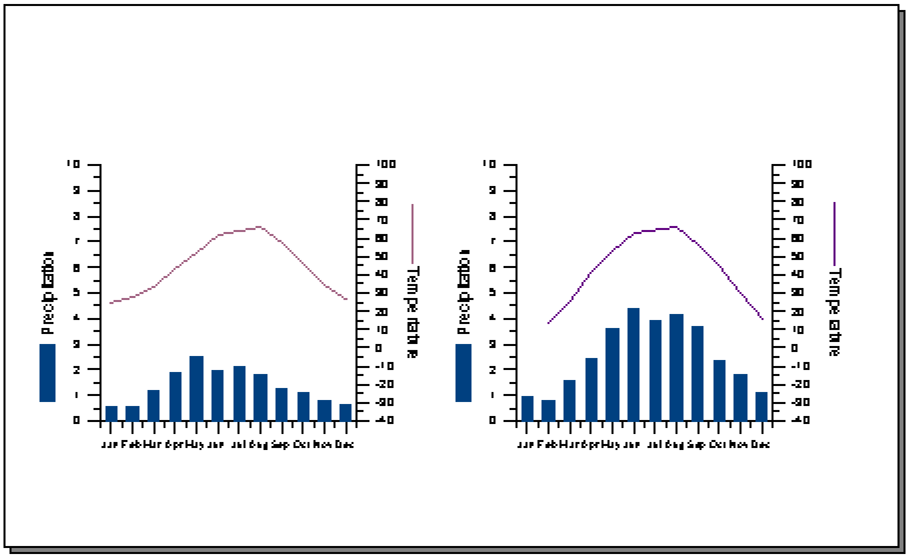
Creating Multiple Graphs on a Page

There are several ways to create more than one graph on a page. The easiest method is to use the mouse, although you can edit the axis properties when creating multiple graphs on a page.

To create multiple graphs on a page:

1. Create the first graph.
2. Select the entire graph.
3. Drag the graph to a new position using the mouse.
4. Create the second graph.
5. Select the entire second graph.
6. Drag the graph to a new position using the mouse.

The graph can also be moved and sized using the axis properties.



To create graphs similar to the one shown above on Legal size paper:

1. Create the first graph.
2. Edit the axis properties. In the left graph, the length and starting positions were set as follows:

- Y Axis 1 (left): *Length* 4.00 inches, *X Position* 1.50 inches, *Y Position* 2.00 inches
- X Axis 1 (bottom): *Length* 4.00 inches, *X Position* 1.50 inches, *Y Position* 2.00 inches
- Y Axis 2 (right): *Length* 4.00 inches, *X Position* 5.50 inches, *Y Position* 2.00 inches

3. Create the second graph.
4. Edit the axis properties. In the right graph, the length and starting positions were set as follows:

- Y Axis 1 (left): *Length* 4.00 inches, *X Position* 8.00 inches, *Y Position* 2.00
- X Axis 1 (bottom): *Length* 4.00 inches, *X Position* 8.00 inches, *Y Position* 2.00 inches
- Y Axis 2 (right): *Length* 4.00 inches, *X Position* 12.00 inches, *Y Position* 2.00 inches

Creating Drawing Objects

Select Tool

Click the **Home | Selection | Select** command or press the ESC key on your keyboard to return the cursor to a and have the ability to select objects.

Insert Tab Commands

The **Insert** tab contains commands to create text, polygons, polylines, or symbols, insert OLE objects, inset zoom, and images, and reshape or edit objects.

None of the **Insert** tab commands are available for the worksheet and grid documents.

Text	Creates a new text block
Polyline	Creates a new polyline
Polygon	Creates a new polygon
Symbol	Creates a new symbol
Spline Polyline	Creates a new spline polyline
Spline Polygon	Creates a new spline polygon
Rectangle	Creates a new rectangle or square
Rounded Rectangle	Creates a new rectangle or square with rounded corners
Ellipse	Creates a new ellipse or circle
Reshape	Moves, adds, or deletes points in the selected polygon, polyline, spline polygon, or spline polyline
Group	Combines the selected objects into a single group object
Ungroup	Breaks a group object into multiple objects
Edit Group / Stop Editing Group	Enters/exits edit group mode, where objects in the group can be added, removed, or edited
Assign Coordinates	Assign coordinates to a bitmap or picture
Digitize	Digitize data from the bitmap, picture, or from a plot

Inset Zoom	Creates a magnified inset of a portion of the page
OLE Object	Inserts an OLE object
Add Graphic	Imports a graphic into the plot

Text

Click the **Home | Draw | Text** or **Insert | Draw | Text** command to create text in a document. The typeface, size, color, style, alignment, opacity, and background can be set for text blocks.

Drawing Text

To create text:

1. Click the **Home |Draw | Text** command to enter text mode. The cursor changes to .
2. Click where you want text to appear in the document. The Text Editor opens.
3. Enter text into the **Text Editor**. Highlight the text to set the text properties. Only text that is highlighted changes text properties.
4. Click *OK* in the **Text Editor** to return to the plot window.
5. Press the ESC key, click theTextcommand, or click another commandto exit text mode.

Setting Text Properties

Change text properties in the Property Manager when a text box is selected. In the **Property Manager** next to the *Text* property, click the button to open the **Text Editor** and change the text properties. You can also double-click on text to open the **Text Editor**.

Frame and Margin

The text background frame and margin are set in the **Property Manager**Text page. The background properties can be changed in the **Text** page or in the **Text Editor**. The *Frame shape* property changes the background shape of the text box from square corners to rounded corners. The *Margin* property sets the padding between the text and the text box frame. Values range between 0 and 1 inches for the *Margin*. To enter a *Margin*, highlight the existing value and type a new value or press the to increase or decrease the value. Press ENTER on the keyboard to make the change.

Linking Text Objects to Worksheet Cells

Grapher allows you to link text objects to worksheet cells. Once the two items are linked, whenever the text in a specified cell is changed, the text object automatically updates to reflect that change. You can link a text object to a worksheet cell in the **Text Editor**. When the worksheet cell contains no information, the linked text will appear empty.

Polygon

Click the **Home | Draw | Area | Polygon** command to draw an irregularly shaped area. Polygons must have at least two vertices (points).

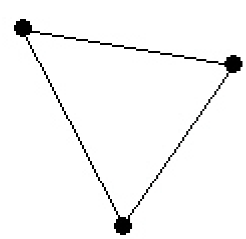
Polygon Properties

Polygons contain two types of properties: line properties and fill properties. You can change these properties in the Property Manager.

Drawing a Polygon

To draw a polygon:

1. Click the **Home | Draw | Area | Polygon** command.
2. Move the cross hair cursor over the location for the start of the polygon and click the left mouse button.
3. Move the cursor to the next position along the line and click again.
4. Continue this procedure until you click the final point, and then press the ENTER key. Alternatively set the final point by double-clicking the left mouse button. The first and last points are automatically connected and the new polygon is drawn.
5. Press the ESC key, click the **Polygon** command, or click another command to exit drawing mode.



This shows a Polygon drawn through three points.

Drawing Tips

- Click points on the page to draw individual points, or click and hold the left mouse button and drag the pointer to draw a continuous stream of points. When drawing a stream of points the plot window auto-scrolls to keep the cursor in the plot window.
- Click the right mouse button to remove the last drawn point. This can be done repeatedly.
- If the CTRL key is pressed while clicking points, the points are constrained to 45-degree angles.
- Double-click the left mouse button or press the ENTER key to close the polygon.
- To cancel drawing a polygon, press the ESC key before closing the polygon.
- Edit the polygon shape by using the Draw | Reshape command.
- Line and fill properties are set through the **Property Manager**.
- Line and fill default properties are set through the File | Options command.
- Drawing mode is persistent for each individual plot document. You can switch to other documents or applications, and polgyon drawing mode will still be enabled when you return to the plot document. Other plot documents may have a different draw tool or the select tool enabled.

Polyline

Click the **Home | Draw | Line | Polyline** command to draw a polyline. A polyline is a collection of one or more connected line segments. You can choose a line style, color, width, opacity, and arrowheads for the polyline display.

Polyline Properties

Polylines contain line properties. You can change these properties in the Property Manager.

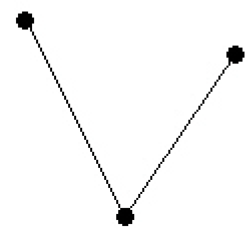
Drawing a Polyline

To draw a polyline:

1. Click the **Home | Draw | Line | Polyline** command to enter drawing mode and begin drawing a polyline.
2. Move the cross hair cursor over the location for the start of the polyline and click the left mouse button.
3. Move the pointer to the next position along the line and click again.
4. Continue this procedure until you click at the final point for the line,

then press the ENTER key. Alternatively, set the final point by double-clicking the left mouse button.

5. Press the ESC key, click the **Polyline** command, or click another command to exit drawing mode.



This shows a Polyline drawn through three points.

Drawing Tips

- Click the endpoints of the line to draw a straight line, or click several points to create an irregularly shaped line.
- Click the right mouse button to remove the last drawn point. This can be done repeatedly.
- Click and hold the left mouse button to create a continuous stream of points. When drawing a stream of points the plot window auto-scrolls to keep the cursor in the plot window.
- If the CTRL key is pressed while clicking points, the points are constrained to 45-degree angles.
- Double-click the left mouse button or press the ENTER key to end the line.
- To cancel drawing the line, press the ESC key before ending the line.
- Edit the shape of the line using the Insert | Reshape command.
- Line properties are set through the **Property Manager**.
- Line default properties are set through the File | Options command.
- Drawing mode is persistent for each individual plot document. You can switch to other documents or applications, and polyline drawing mode will still be enabled when you return to the plot document. Other plot documents may have a different draw tool or the select tool enabled.

Symbol

Symbols are markers that are used to indicate point positions. Any TrueType glyph can be used as a symbol, including several custom glyphs provided with **Grapher**. You can use the **Home | Draw | Symbol** command to place symbols in the document. You can change the symbol color, size, set, and opacity in the Property Manager.

Symbol Properties

Symbols contain symbol properties. You can change these properties in the Property Manager.

Drawing a Symbol

To draw a symbol:

1. Click the **Home |Draw | Symbol** command to enter drawing mode.
2. Click on a location in the plot window to create a symbol.
3. Press the ESC key, click the **Symbol** command, or click another command to exit drawing mode.

Drawing Tips

- Set symbol properties through the **Property Manager**.
- Set symbol property defaults through the File | Defaults command.
- Drawing mode is persistent for each individual plot document. You can switch to other documents or applications, and symbol drawing mode will still be enabled when you return to the plot document. Other plot documents may have a different draw tool or the select tool enabled.

Rectangle

Click the **Home | Draw | Area | Rectangle** command to create a rectangle or square in the document.

Rectangle Properties

Rectangles contain two types of properties: line properties and fill properties. You can change these properties in the Property Manager.

Drawing a Rectangle

To draw a rectangle:

1. Select the **Home | Draw | Area | Rectangle** command to enter drawing mode and begin drawing a rectangle.
2. Press and hold the left mouse button at one corner of the rectangle.

3. Drag the pointer to the opposite corner of the rectangle. The size of the rectangle appears in the status bar as it is drawn.
4. Release the left mouse button when the rectangle is the preferred size and shape.
5. Press the ESC key, click the **Rectangle** command, or click another command to exit drawing mode.

Drawing a Square

To draw a square, hold down the CTRL key while dragging the mouse to draw a square rather than a rectangle.

Drawing Tips

- Line and fill properties are set through the **Property Manager**.
- Line and fill default properties are set through the File | Options command.
- You can draw a rectangle out from the center rather than corner to corner by holding down the SHIFT key while dragging the mouse.
- You can draw a square out from the center rather than corner to corner by holding down the CTRL and SHIFT key while dragging the mouse.
- The plot window auto-scrolls to keep the cursor in the plot window when drawing a rectangle.
- Drawing mode is persistent for each individual plot document. You can switch to other documents or applications, and rectangle drawing mode will still be enabled when you return to the plot document. Other plot documents may have a different draw tool or the select tool enabled.

Rounded Rectangle

Click the **Home | Draw | Area | Rounded Rectangle** command to create a rounded rectangle or square in the document.

Rounded Rectangle Properties

Rounded rectangles contain two types of properties: line properties and fill properties. You can change these properties in the Property Manager.

Drawing a Rounded Rectangle

To draw a rounded rectangle:

1. Select the **Home | Draw | Area | Rounded Rectangle** command to enter drawing mode and begin drawing a rounded rectangle.
2. Press and hold the left mouse button at one corner of the rounded rectangle.
3. Drag the pointer to the opposite corner of the rounded rectangle. The size of the rounded rectangle appears in the status bar as it is drawn.
4. Release the left mouse button when the rounded rectangle is the preferred size and shape.
5. Press the ESC key, click the **Rounded Rectangle** command, or click another command to exit drawing mode.

Drawing a Rounded Square

To draw a rounded square, hold down the CTRL key while dragging the mouse to draw a rounded square rather than a rounded rectangle.

Drawing Tips

- Line and fill properties are set through the **Property Manager**.
- Line and fill default properties are set through the File | Options command.
- You can draw a rounded rectangle out from the center rather than corner to corner by holding down the SHIFT key while dragging the mouse.
- You can draw a rounded square out from the center rather than corner to corner by holding down the CTRL and SHIFT key while dragging the mouse.
- The plot window auto-scrolls to keep the cursor in the plot window when drawing a rounded rectangle.
- Drawing mode is persistent for each individual plot document. You can switch to other documents or applications, and rounded rectangle drawing mode will still be enabled when you return to the plot document. Other plot documents may have a different draw tool or the select tool enabled.

Ellipse

Click the **Home | Draw | Area | Ellipse** command to create an ellipse or circle in the plot document.

Ellipse Properties

Ellipses contain two types of properties: line properties and fill properties. You can change these properties in the Property Manager.

Drawing an Ellipse

To draw an ellipse:

1. Click the **Home | Draw | Area | Ellipse** command.
2. Press and hold the left mouse button at one corner of the bounding box of the ellipse.
3. Drag the cursor to the opposite corner of the ellipse. The size of the ellipse’s bounding box appears in the status bar as it is drawn.
4. Release the left mouse button when the ellipse is the preferred size and shape.
5. Press the ESC key, click the **Ellipse** command, or click another command to exit drawing mode.

Drawing a Circle

To draw a circle, hold down the CTRL key while dragging the mouse to draw a circle rather than an ellipse.

Drawing Tips

- Draw an ellipse out from the center rather than corner to corner by holding down the SHIFT key while dragging the mouse.
- Draw a circle out from the center rather than end to end by holding down the SHIFT and CTRL keys while dragging the mouse.
- Line and fill properties are set through the **Property Manager**.
- Line and fill default properties are set in the File | Options dialog.
- The plot window auto-scrolls to keep the cursor in the plot window when drawing an ellipse.
- Drawing mode is persistent for each individual plot document. You can switch to other documents or applications, and ellipse drawing mode will still be enabled when you return to the plot document. Other plot documents may have a different draw tool or the select tool enabled.

Spline Polyline

Click the **Home | Draw | Line | Spline Polyline** command to draw a spline polyline. A spline polyline is a smooth, flowing polyline with no sharp or distinct angles. You can choose a line style, line color, opacity, width, and arrowhead style for the spline polyline display.

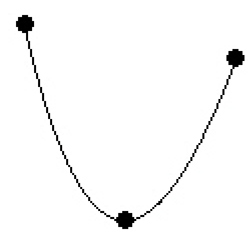
Spline Polyline Properties

Spline polylines contain line properties. You can change these properties in the Property Manager.

Drawing a Spline Polyline

To draw a spline polyline:

1. Click the **Draw | Spline Polyline** command to enter drawing mode and begin drawing a spline polyline.
2. Move the cross hair pointer over the location for the start of the spline polyline and click the left mouse button.
3. Move the pointer to the next position along the line and click again. Generate the spline polyline by clicking on the anchor points during the polygon creation. The anchor points identify a change in the spline polyline's shape and direction. Notice that the spline polyline shape is visible and that you can change its curvature by moving the mouse.
4. Continue clicking on the anchor points until you click the final point, then press the ENTER key. Alternatively double-click the left mouse button to set the final point and complete the spline polyline. The new spline polyline is drawn.
5. Press the ESC key, click the **SplinePolyline** command, or click another command to exit drawing mode.



This shows a Spline Polyline drawn through three points.

Drawing Tips

- Click points on the page to draw a spline polyline, or click and hold the left mouse button and drag the pointer to draw a continuous stream of points. When drawing a stream of points the plot window auto-scrolls to keep the cursor in the plot window.
- If the CTRL key is pressed while clicking points, the points are constrained to 45-degree angles.

- Click the right mouse button to remove the last drawn point. Repeated clicking of the right mouse button removes all points in reverse order.
- Double-click the left mouse button or press the ENTER key to close the spline polyline.
- Press the ESC key to cancel drawing the spline polyline before ending the line.
- Click the Insert | Reshape command to change the spline polyline's shape.
- Edit the spline polyline properties in the Property Manager.
- Change the properties for a group of selected spline polylines in the **Property Manager**.
- Use the File | Options command to set the default line properties for the spline polyline.
- Drawing mode is persistent for each individual plot document. You can switch to other documents or applications, and spline polyline drawing mode will still be enabled when you return to the plot document. Other plot documents may have a different draw tool or the select tool enabled.

Spline Polygon

Click the **Home | Draw | Area | Spline Polygon** command to create a spline polygon. Spline polygons are smooth, flowing areas with no sharp or distinct angles.

Spline Polygon Properties

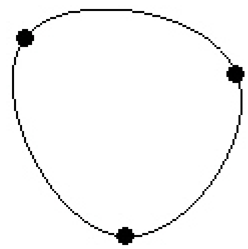
Spline polygons contain two types of properties: line properties and fill properties. You can change these properties in the Property Manager.

Drawing Spline Polygons

To draw a spline polygon:

1. Click the **Home | Draw | Area | Spline Polygon** command to enter drawing mode and begin drawing a spline polygon.
2. Move the cross hair pointer over the location for the start of the spline polygon and click the left mouse button.
3. Move the pointer to the next position along the line and click again. Generate the spline polygon by clicking on the anchor points during the polygon creation. The anchor points identify a change in the spline polygon's shape and direction. Notice that the spline polygon shape is visible and that you can change its curvature by moving the mouse.

4. Continue clicking on the anchor points until you click the final point, and then press the ENTER key. Alternatively double-click the left mouse button to set the final point complete the spline polygon. The new spline polygon is drawn.
5. Press the ESC key, click the **SplinePolygon** command, or click another command to exit drawing mode.



This shows a Spline Polygon drawn through three points.

Drawing Tips

- Click points on the page to draw a spline polygon, or click and hold the left mouse button and drag the pointer to draw a continuous stream of points. When drawing a stream of points the plot window auto-scrolls to keep the cursor in the plot window.
- If the CTRL key is pressed while clicking points, the points are constrained to 45-degree angles.
- Click the right mouse button to remove the last drawn point. Repeated clicking of the right mouse button removes all points in reverse order.
- Double-click the left mouse button or press the ENTER key to close the spline polygon.
- Press the ESC key to cancel drawing the spline polygon before ending the line.
- Use the Insert | Reshape command to change the spline polygon's shape.
- Change the properties for a group of selected spline polygons in the **Property Manager**.
- Line and fill properties are set through the **Property Manager**.
- Line and fill default properties are set through the File | Options command.
- Drawing mode is persistent for each individual plot document. You can switch to other documents or applications, and spline polygon drawing mode will still be enabled when you return to the plot

document. Other plot documents may have a different draw tool or the select tool enabled.

Reshape

Click the **Insert | Reshape** command to move, add, and delete vertices within a selectedpolyline, spline polyline, polygon, or spline polygon. Polylines and polygons in broken apart metafiles can be edited with **Reshape** as well. All vertices in the selected object are shown with hollow squares and the lines are shown in red. Click on a vertex to select it. The selected vertex is indicated by a solid green square.

Entering the Reshape Mode

Use the **Insert | Reshape** command to enter reshape mode. Alternatively, select the polyline, spline polyline, polygon, or spline polygon, right-click and select **Reshape**. The cursor changes to , indicating you are in reshape mode. The **Reshape** command also remains highlighted to indicate you are in reshape mode. You can also right-click on the object in the **Object Manager**and select**Reshape**. While in reshape mode you can click another object to select it and edit its vertices.

Exiting the Reshape Mode

To exit reshape mode press the ESC key on the keyboard, click another command or toolbar button, or click the **Reshape** command again.

Selecting Vertices

- Left-click on a vertex to select it. The selected vertex is indicated by a solid green square.
- To select the first vertex, press the HOME key. To select the last vertex, press the END key.
- To shift the selected vertices forward by one position, press the TAB key. To shift the selected vertices backward by one position, hold the SHIFT key and press the TAB key.
- To select multiple vertices, hold down the SHIFT key and left-click additional vertices or left-click and drag the cursor to make a rectangular block selection. Vertices can be added or removed from the block selected vertices by holding down the SHIFT key.
- Hovering the mouse over an unselected vertex will display a grey highlight around the vertex indicating it may be selected or dragged.
- The cursor will change to + when it is over a vertex to indicate the vertex may be selected or dragged.

- If you have multiple polyline or polygon objects in the plot window, you can edit multiple objects while in the reshape mode. Vertices can only be edited for the selected object. Click on another object to select it.

Moving Vertices

One vertex can be moved by clicking and dragging the selected vertex to the desired location. Multiple vertices can be moved by selecting the vertices, and then clicking and dragging one of the selected vertices. Press ESC while holding down the left mouse button to cancel the move. Pressing ESC while NOT dragging will exit reshape mode.

Deselecting Vertices

All vertices can be deselected by clicking in unused space. Click on another vertex to select it and deselect the currently selected vertex. A selected vertex can be deselected by holding down the SHIFT key and left-clicking the vertex.

Adding Vertices

Hold the CTRL key and the cursor changes to +, indicating add vertex mode. Left-click where you want a new vertex added and a new node will be added to the closest point on the existing object.

Deleting Vertices

Select a vertex or multiple vertices with one of the methods outlined above. Press DELETE to remove the selected vertex or vertices, and the next vertex in the object is selected. You can hold DELETE to remove contiguous vertices as the selection moves through the object. Degenerate polygons (two-point polygons) can be created by removing vertices. Polylines, polygons, spline polylines, and spline polygons are deleted when there are fewer than two vertices.

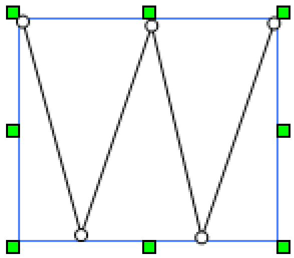
Undoing Edits

The Undo command will undo each individual change in reshape mode.

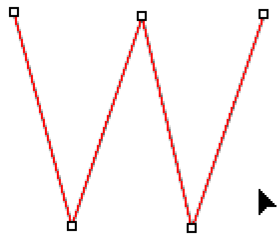
Example

To edit a polyline, spline polyline, polygon, or spline polygon:

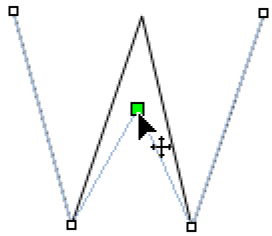
1. Select the object.



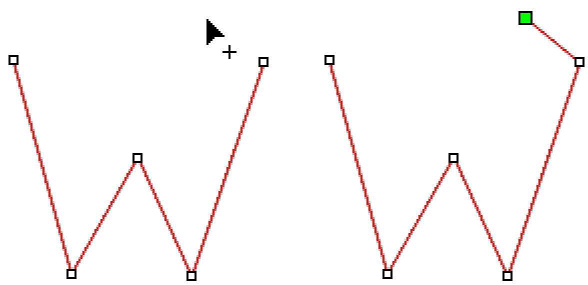
2. Click the **Insert | Reshape** command. The arrow pointer turns into an arrowhead pointer and all the vertices appear as small hollow squares.



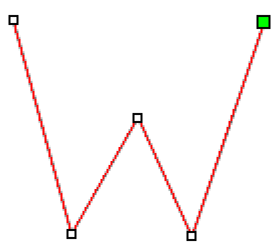
3. To move a vertex, left-click on the vertex, hold the left mouse button down, and drag it to a new location.



4. To add a vertex, hold down the CTRL key, the cursor changes to +, and left-click where you want the new vertex added.



5. To delete a vertex, select it and then press the DELETE key.



6. After reshaping the object, press the ESC key to end reshaping mode and keep the changes.

Inset Zoom

Click the **Insert | Inset Zoom** command to magnify any portion of the plot page. This type of inset is similar to changing the zoom level of the screen. The magnified inset area is referred to as the "zoomed area box." The original area defined when drawing the inset zoom boundary is referred to as the "area selection box." The items in the zoomed area box are cut off exactly at the area selection box.

Inset Zoom Properties

The inset zoom contains the following sections in the Property Manager:

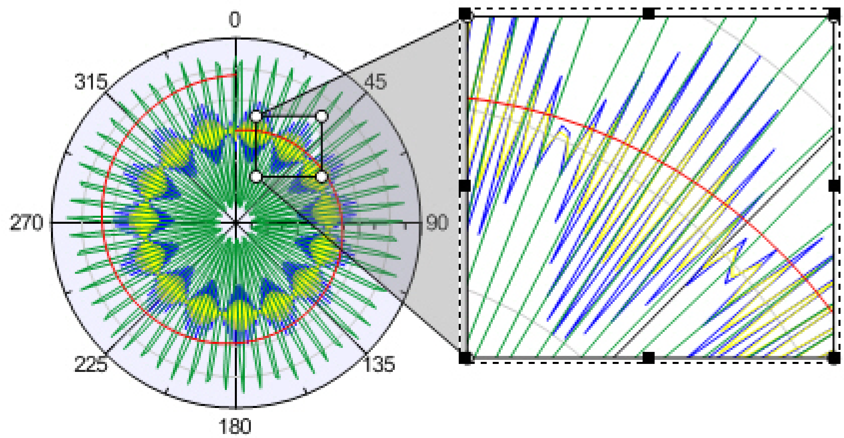
Magnifier

Line

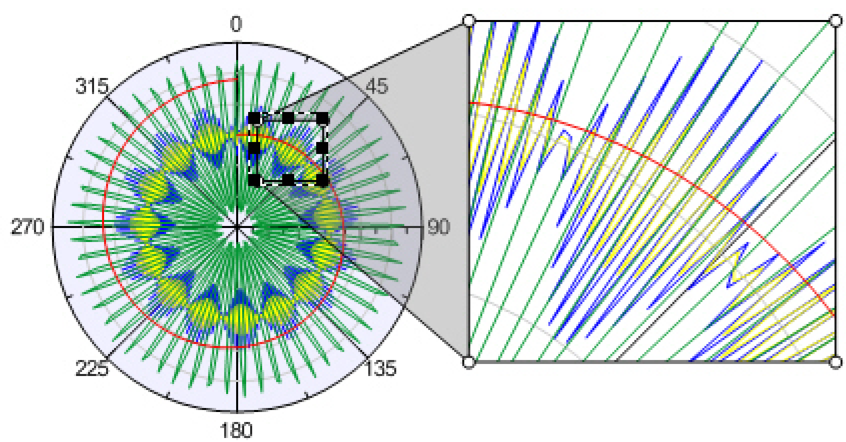
Fill

Switching Selected Box

The zoomed area box is selected by default. Right-click on the inset zoom and select **Switch box** to switch to the area selection box and vice versa. Alternatively, in the **Property Manager**, click the **Magnifier** tab and change the selection for *Selected box*.



In this example, the zoomed area box is selected.
The selected box has eight black squares surrounding it.



In this example, the area selection box is selected.
The selected box has eight black squares surrounding it.

Moving the Inset Zoom

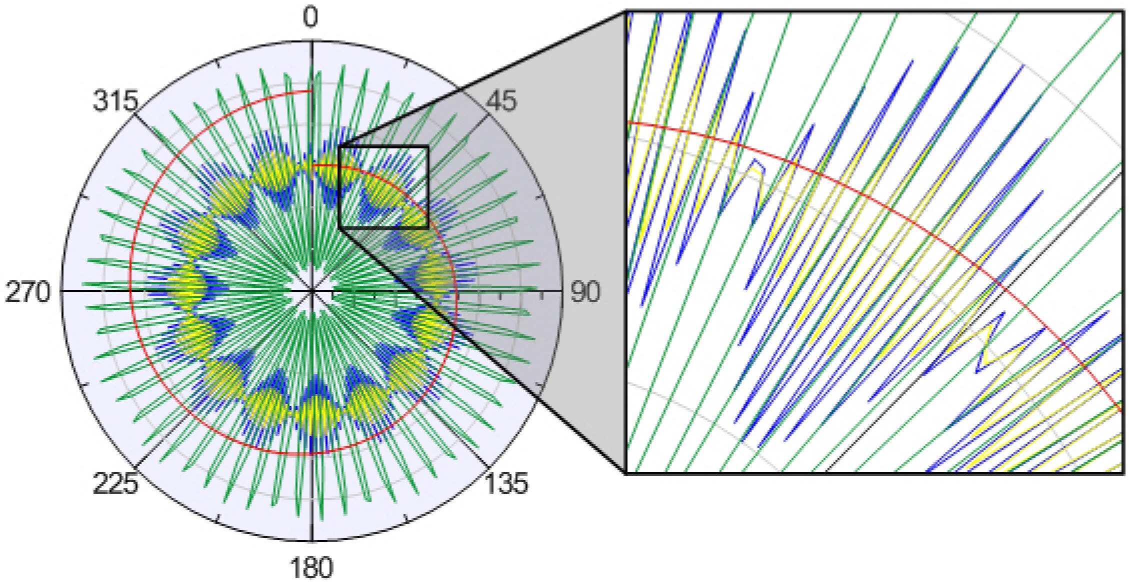
If the zoomed area box is moved, the lines connecting it to the area selection box are automatically drawn to the new location. If the area selection box is moved, the zoomed area box is automatically updated to display the new information.

Drawing an Inset Zoom

To create an inset zoom:

1. Click the **Insert | Inset Zoom** command. The cursor changes to  to indicate inset zoom mode.
2. Press and hold the left mouse button at one corner of the inset area.

3. Drag the pointer to the opposite corner of the inset area. The size of the inset area appears in the status bar as it is drawn.
4. Release the left mouse button when the inset area is the preferred size and shape.
5. Use the **Property Manager** to change the inset properties.



*The **Insert | Inset Zoom** command can be useful to magnify a portion of a graph or the plot page.*

Drawing Tips

- Line and fill properties are set through the **Property Manager**.
- Line and fill default properties are set in the File | Options command.
- You can draw an inset zoom out from the center rather than corner to corner by holding down the SHIFT key while dragging the mouse.
- You can draw a square inset zoom by holding down the CTRL key while dragging the mouse.
- You can draw a square inset zoom out from the center rather than corner to corner by holding down the CTRL and SHIFT key while dragging the mouse.

Selecting Objects

Selecting Objects

There are several ways to select objects in **Grapher**. An object is selected if there is a bounding box with selection handles surrounding the object. The name of the selected object appears in the status bar. You can set some selection options in the *General* section after selecting the File | Options command.

Several procedures are available to select objects in a plot window:

- Objects may be selected using the Object Manager. If an object is selected in the **Object Manager**, it is also selected in the plot window and vise versa.
- To select a single object in the plot window, move the pointer over the object using the mouse or the arrow keys. When the pointer is over the desired object, click the left mouse button or press the SPACEBAR on the keyboard. Eight square selection handles appear, indicating that the object is selected.
- Bounding boxes for several objects may be overlapping if an object, other than the one you want, is selected. Hold down the CTRL key and click with the mouse until the desired object is selected. Any objects that were previously selected become deselected.
- To select two or more objects in the plot window, hold down the SHIFT key while making your selections. This retains previously selected objects and includes the newly selected objects. You can hold down both the CTRL and SHIFT keys to select several objects with overlapping bounding boxes.
- The block select mouse procedure allows you to select one or more objects contained in a user-defined rectangle. Press and hold the left mouse button on an empty portion of the plot window. Drag the mouse to form a rectangle around the group of objects you wish to select. Alternatively, you can use the arrow keys to position the pointer on an empty portion of the plot window, press and hold the SPACEBAR, and move the pointer with the ARROW keys. In the File | Options dialog, in the Selection section, use the*Rectangle must fully surround* option to control how the block select command functions. If the box is checked, the block select rectangle must be drawn completely around the object to select it. If any portion of the object extends beyond the block select rectangle, the object is not selected. If this option is unchecked, the block select rectangle only needs to partially intersect an object to select it.
- The Home | Selection | Block Select command allows you to select one or more objects. This command operates the same as the procedure above.
- In the File | Options dialog, in the Selection section, check theSelect *using full bounds box* option to click anywhere within an object’s bounding box to select the object. If this check box is not checked, you must click directly on an object in order to select it; clicking on any white space around the object does not select an object. If this is not checked, clicking inside an unfilled rectangle will not select it, either.
- The Home | Selection | Select All command is used to select all the

objects in the plot window. Pressing the CTRL+A keys performs the same command.

- The Home | Selection | Invert command selects all deselected objects and deselects all selected objects. This command is useful for selecting a large number of objects and leaving a few isolated objects deselected. Select the objects you do not want to select and use the **Home | Selection | Invert** command.
- The TAB key can be used to cycle through all objects, selecting each one at a time.

Multiple Selection Properties

To select two or more objects in the plot window, hold down the SHIFT key while making your selections. This retains previously selected objects and includes the newly selected objects.

If you have selected multiple objects, the Property Manager may include one or more of the following sections, depending on the selected object types.

Fill Properties
Line Properties
Symbol Properties
Text Editor
Text Properties

Select All

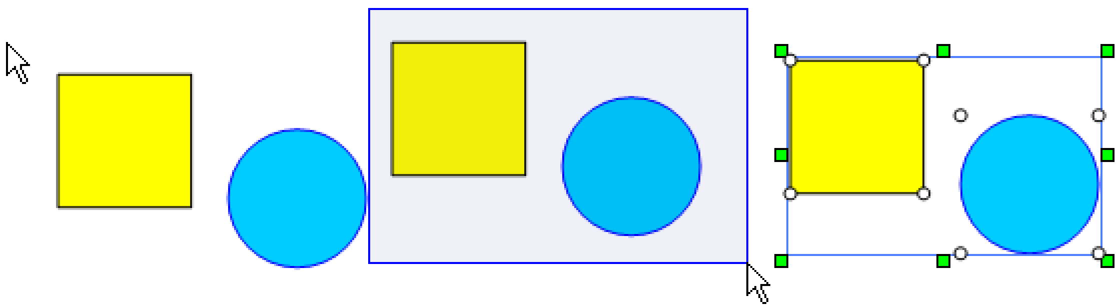
Click the **Home | Selection | Select All** command or press CTRL+A on the keyboard to select all objects in the document. A bounding box surrounds all selected objects.

Block Select

Click the **Home | Selection |Block Select** command to select items by dragging a rectangle around them. The block select command is available at all times in the program even without clicking the **Home | Selection | Block Select** command. However, the **Block Select** command is useful to make a block selection without accidentally selecting and moving another object.

To perform a block selection, click outside one corner of the object, hold the left mouse button down, and then drag the mouse to the opposite corner of the objects. A block select boundary line is drawn as you move the mouse. When all of the objects you are selecting are within the boundary line, release the left mouse button and the objects that were inside the block select boundary are selected.

To avoid accidentally moving an object when block selecting, click the **Home | Selection |Block Select** command or lock the object's position before block selecting. If an object is properly selected, a bounding box surrounds the object. You can set block select options in the Selection section of the File | Options dialog.



Click outside one corner of the object.

Hold the left mouse button down and drag the mouse to the opposite corner of the objects.

Release the left mouse button and the objects inside the bounding box are now selected.

Deselect All

Click the **Home | Selection |DeselectAll** command or press CTRL+SHIFT+A to deselect all selected objects. This command is useful when zoomed in on objects. Alternatively, you can deselect objects by clicking in the white space in the plot document.

Invert

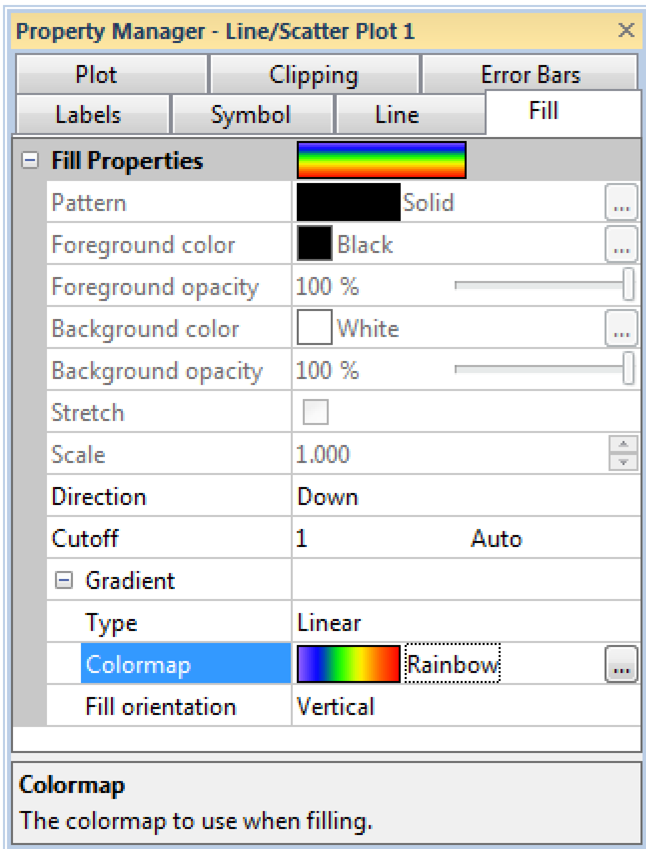
Click the **Home | Selection | Invert** command to reverse the selected and deselected objects. A bounding box surrounds all selected objects.

Object Properties

Fill Properties

Fill properties can be changed for selected objects. To edit the fill properties, click on the object in the Object Manager or plot window. The properties are listed in the Property Manager on the **Fill** tab.

The **Fill** page in the **Property Manager** contains properties for all fills in the object. For example, a 3D ribbon/wall plot **Fill** page will include a *Ribbon Fill Properties* section for the ribbon fill, an *Error Bar Fill Properties* section for the error bar fill, and a *Wall Fill Properties* section for the wall fill.



The fill properties are set in the ***Property Manager*** *on the* ***Fill*** *tab.*

Sample

The sample shown next to the *Fill Properties* line shows the selected pattern, foreground color, and background color.

Pattern

The *Pattern* indicates the way that an object is filled. To change the *Pattern,* click on the existing pattern sample next to *Pattern*. In the list, select a new pattern from the fill palette. There are two types of fill patterns: Windows stock and bitmap images. Stock patterns and some bitmap patterns can have different foreground and background colors. All patterns can have the foreground or background color partially transparent.

Bitmap patterns can be scaled. Bitmap patterns are not available for contour maps, or surface maps. Click the ... to the right of the *Pattern* to import an image to use as a bitmap fill. For bar charts, you may wish to use the *Image* bar Bar style rather than a bitmap fill.

Foreground Color

The Foreground color is the color of the pattern lines or pixels. Click the existing color sample next to *Foreground color* to open the color palette. Click on a color in the palette to use it for the selected foreground fill color. Click the ... button to the right of the color sample to open the **Colors** dialog, setting a custom color.

Foreground Opacity

The *Foreground opacity* controls the transparency of the foreground portion of the pattern. To change the *ForegroundOpacity*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click and drag the slider to change the opacity percentage. Opacity values are between 0% (zero opacity, full transparency) to 100% (full opacity, zero transparency).

Background Color

The Background color is the color behind the pattern. All patterns must have a background color. If you do not wish to see the background color, change the *Background opacity* to 0%. Click the existing color sample next to *Background color* to open the color palette. Click on a color in the palette to use it for the selected foreground fill color. Click the ... button to the right of the color sample to open the **Colors** dialog, setting a custom color.

Background Opacity

The *Background opacity* controls the transparency of the background portion of the pattern. To change the *Background opacity*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click and drag the slider to change the opacity percentage. Opacity values are between 0% (zero opacity, full transparency) to 100% (full opacity, zero transparency).

To make a fill pattern appear transparent with only the foreground portion of the fill pattern showing, change the *Background opacity* value to 0%.

Stretch

Check the *Stretch* option to stretch image fills to completely fill the geometry. If *Stretch* is not selected, the image will be repeated to fill the geometry.

Scale

The *Scale* controls the density of the bitmap fill *Pattern*. Clear the box next to the *Stretch* option and set the *Scale* factor to a value between 0.1 and 10. The larger the *Scale*, the larger the resulting pattern.

Direction

You can fill the plot in one of four directions by selecting one of the following from the *Direction* list. *Down* fills the area under the curve to the minimum Y *Cutoff* value. *Up* fills the area above the curve to the maximum Y *Cutoff* value. *Left* fills the area to the left of the curve to the minimum X *Cutoff* value. *Right* fills the area to the right of the curve to the maximum X *Cutoff* value.

When a Between Fill plots is used, the *Direction* options allow you to specify *Horizontal* or *Vertical*.

Cutoff

The *Cutoff* value controls the limits of the fill. To set the *Cutoff* value, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. To return the *Cutoff* to the default value, click the word *Custom* and it will return to *Auto*. When the *Cutoff* is set to *Auto*, the value is the minimum or maximum axis value.

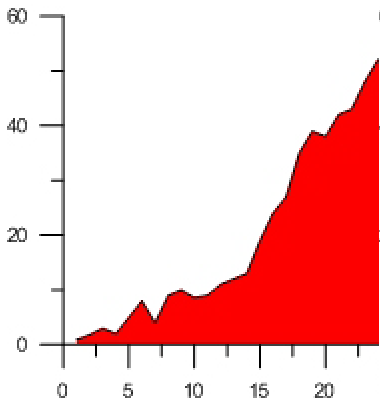
For example, if *Up* is the selected *Direction* and the *Cutoff* is set to *Auto*, the fill will go to the Y axis maximum value. If 20 is entered as the *Cutoff*, the fill is above the curve to the Y Axis value of 20. Any area above the curve that is greater than the Y Axis value of 20 is not filled.

Gradient

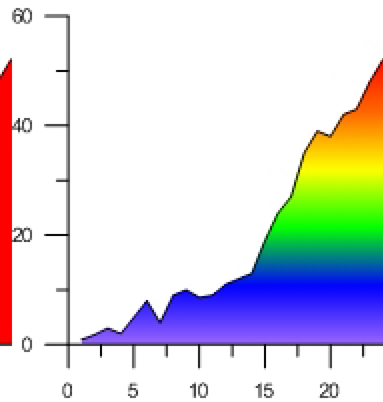
The *Gradient* section sets the fill pattern to a gradient fill.

Gradient Type

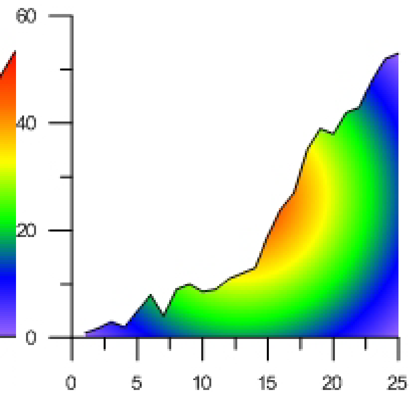
The *Type* controls whether a gradient fill pattern is used to fill the selected area. To change the *Type*, click on the current type and select the new type in the list. Select *None, Linear,* or *Radial* for the *Type*. When the *Type* is set to *None,* the gradient fill options are disabled. The fill is determined by the *Pattern, Foreground,* and *Background* options. When the *Type* is set to *Linear,* a linear color gradient fills the area. The colors change in a linear manner from the top to the bottom or from the left to the right of the area. When the *Type* is set to *Radial,* a radial color gradient fills the area. The colors change in concentric circles, either expanding from the interior and going out or from the exterior and going in. Some 3D objects, such as 3D bar charts, do not support *Radial* gradient fill.



This example has Type *set to None.*



This example has Type *set to Linear.*



This example has Type *set to Radial.*

Colormap

The *Colormap* option fills the graph components with a color gradient. Click the existing color gradient and select the desired predefined gradient from the list. Click the  button to the right of the color gradient to open the Color Gradient dialog. This option is disabled if the *Type* is set to *None*.

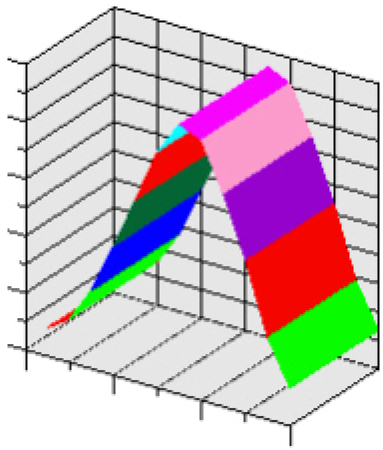
Fill Orientation

The *Fill orientation* option sets the direction the gradient fills. When the *Type* is set to *Linear*, choose either *Vertical* or *Horizontal* for the *Fill orientation.* The *Vertical* option sets the gradient to change along the Y axis. The *Horizontal* option sets the gradient to change along the X axis. When *Radial* is selected as the *Type*, the *Fill orientation* options are *Inward* and *Outward*. This reverses the color direction. The *Fill orientation* option is not available when the *Type* is set to *None*.

The color gradient can be mapped to plot values when the *Fill orientation* is set to *Linear*. However the *Data to Color Mapping* section of the **Color Gradient** dialog is not available when the *Fill orientation* is set to *Radial*.

Use Plot Line Color for Ribbon Fill

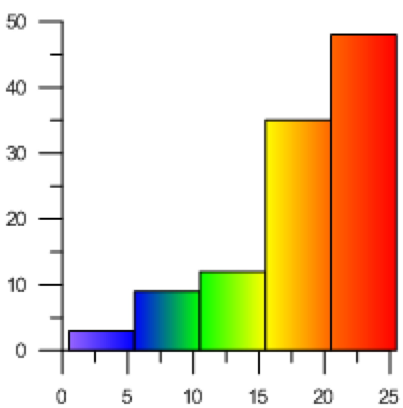
For [3D XYY ribbon/wall plots](), when the [Line]() *Color column* is specified, the *Use plot line color for ribbon fill* option is available. The ribbon uses the same color as the *Color column* when the *Use plot line color for ribbon fill* option is checked.



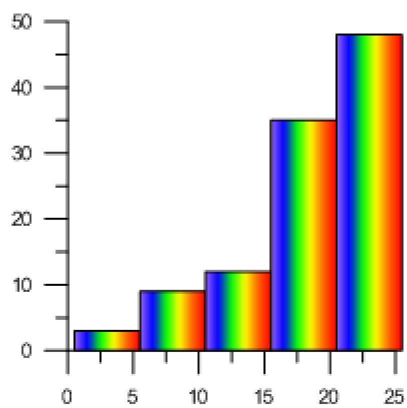
The ribbon segments are filled with the same color as the line segments.

Spread Across Plot

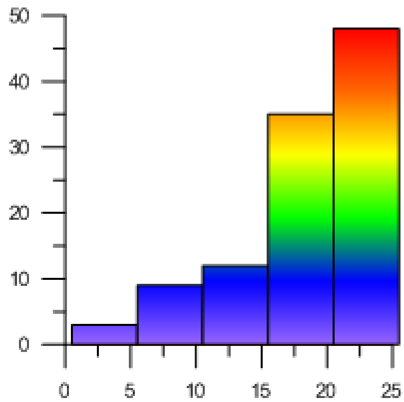
The *Spread across plot* option is only available for 2D and 3D XYY bar charts, floating bar charts, and histogram plots. When this option is checked, the gradient fills across the entire plot rather than on a bar basis for histograms, bar charts, and floating bar charts. The spindle and diamond bar types do not support this feature in 3D charts.



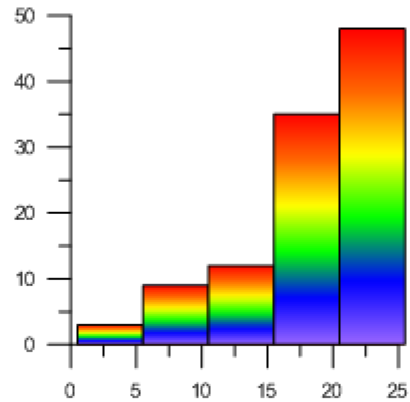
This example has Spread across plot *option checked with Horizontal as the* Fill orientation*.*



This example has Spread across plot *option cleared with Horizontal as the* Fill orientation*. Each bar is individually filled* *with the gradient.*



This example has Spread across plot *option checked with Vertical as the* Fill orientation*.*



This example has Spread across plot *option cleared with Vertical as the* Fill orientation*. The bars are individually filled with the gradient.*

Filling Bar Charts with Color Column

The *Color column* option is available to 2D bar charts, floating bar charts, histograms, polar bar charts, box-whisker plots, bubble plots, 3D XYY bar charts, floating bar charts, histograms, 3D XYZ bar charts, and floating bar charts. The *Color column* option allows you to select colors from a specific column in the worksheet to use as the *Foreground* color. Each bar is colored from the designated worksheet column. If a worksheet row does not have a color specified, the *Foreground* color is used for that bar.

Colors can be specified in the worksheet by many different methods.

Method	**Example**
<color>	Red
<color>:<a>	Red:255
RGB(<r>,<g>,<b>)	RGB(255,0,0)
\COLOR(<r>,<g>,<b>,<a>)	\COLOR(255,0,0,255)
R<r> G<g> B<b>	R255 G0 B0
R<r> G<g> B<b> A<a>	R255 G0 B0 A255
\RGBR<r> \RGBG<g> \RGBB<b>	\RGBR255 \RGBG0 \RGBB0

where <r>, <g>, <b>, and <a> are red, green, blue, and alpha values between 0 - 255 and <color> is a color name as it appears in the color palette.

Filling Bar Charts with Color Table

Check the box next to *Use color table* to specify the bar chart bar color from a color table. The *Color table* option becomes active. Uncheck the box next to *Use color table* to turn off the color table functionality. A color table can allow each bar to use a separate color and fill property or the a repeating color and fill property. The Color Table dialog allows you to assign a color to each bar in the chart.

Color Table

Click the *Set* button next to *Color table* to open the Color Table dialog and control which colors are used in the graph.

Show Color Table Legend

Select the *Show color table legend* property to display a color table legend.

Different Fill for Bars

Select the *Different fill if bars<base* to add a second *Fill Properties* section. The *Fill Properties (bars>base)* section controls the fill colors for the bars that extend up from the base value. The *Fill Properties (bars<base)* section controls the fill colors for the bars that extend down from the base value.

Default Fill Properties

You can set most default fill properties in the *Defaults*section of the File | Options command.

Color Palette

The color palette is opened by clicking the color sample or button.

- The name of the color appears at the top of the palette.
- Select a color from the palette by clicking on a color.
- Create a custom colors by clicking the ... button to the right of the selected color.

Use the color palette to select a color.

Custom Colors

In the **Property Manager**, click the button to the right of the selected color to open the **Colors** dialog and select a standard color or create new colors.

The **Colors** dialog has two pages: **Standard** and **Colors**.

Standard Page
Select a color from the standard color palette on the Standard page.

Colors Page
Create new colors by adjusting *Hue, Sat, Lum, Red, Green,* and *Blue* values on the Custom page.

Custom Fill Pattern

There are two types of fill patterns: Windows stock and bitmap patterns. You can import custom bitmap patterns to the fill palette with the *Custom* button in the fill palette.

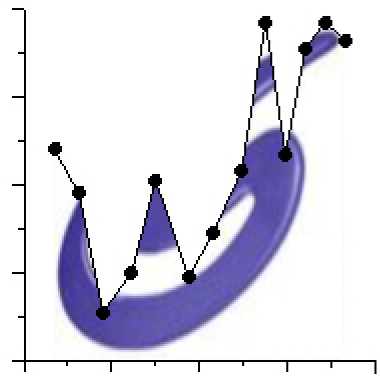
Import a Custom Fill Pattern

To create a custom pattern:

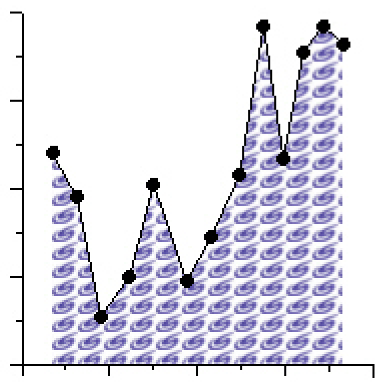
1. Open the fill properties. You can open the fill properties by selecting an object that can contain fill (for example, a rectangle) and opening the **Fill** tab in the Property Manager.
2. Click the button to the right of the sample fill *Pattern*.
3. In the**Import**dialog, select an image file (i.e. .JPG, .BMP, .TIF, etc.),

and click the*Open*button.

4. The custom pattern is added to the bottom of the fill palette and is automatically selected.
5. Check or uncheck the *Stretch* option to display the custom fill as either tiled or stretched.



This custom fill was created with a .JPG file. The Stretch *option is checked.*



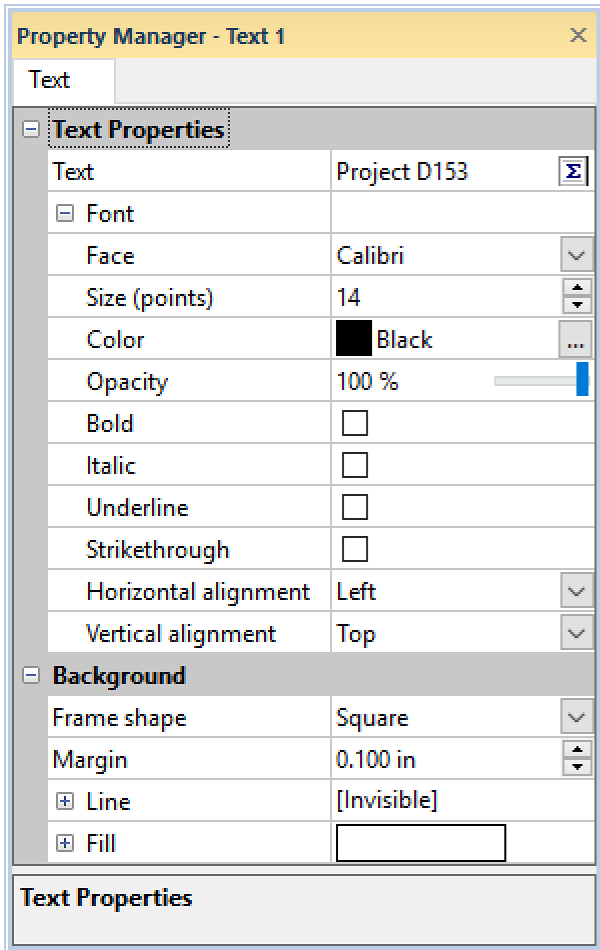
This custom fill was created with a .JPG file. The Stretch *option is unchecked.*

Delete a Custom Fill Pattern

Custom fill patterns are stored in the CustomPicturePatterns.bin file for later use. This file cannot be edited. However, you can delete all custom fill patterns by deleting this file. Use the CustomPicturePatterns.bin file located in the AppData directory to delete custom fill patterns from the fill palette.

Text Properties

Text properties can be changed for most text objects. To set properties for most text objects, open the *Font*section in the Property Manager to set the text or label properties.



The text properties appear in the ***Property Manager***
in a Text Properties *section or* Font *section.*

Text

Quickly set the text by typing directly in the *Text* field. Math text instructions can be used in the title *Text* field. Click in the *Text* field to add complex formatting or text in the Text Editor dialog.

Math text instructions are used to apply unique formatting to characters or words in the text and to create multi-line text. When a change is made to the entire *Text* string in the **Text Editor**, the following *Font* properties are updated. Conversely, changing any of the *Font* properties affects the entire *Text* string. However, math text instructions take precedence over

Font properties. When a change is made to a subset of the text, the **Text Editor** adds the appropriate math text instructions to the *Text* field.

Face

The *Face* is the font that is used for the text. To change the *Face*, click on the current font name. Select the desired font name from the list. Click the arrow button or select a font and use the ARROW keys on the keyboard to scroll through the *Face* list. The selected font is displayed in the **Text Editor**. The font files that are installed on your computer are displayed in the Font list. **Grapher** supports true type fonts.

Size (Points)

Set the text size in the *Size (points)* field. Highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the size. A *Size (points)* value between zero and 720 can be specified.

Color

Change the *Color* of the text by clicking on the color box. Select a new color by clicking on a color in the color palette. Create [new colors] by clicking the button to the right of the color name.

Opacity

The *Opacity* controls the transparency of the text. Select a value between 0% (zero opacity, full transparency) to 100% (full opacity, zero transparency). To set the opacity, highlight the existing value and type a new number. Press ENTER on the keyboard to make the change. Alterantively, click and drag the to change the opacity percentage.

Style

In most instances, there are check boxes for the style options. Check the box next to*Bold, Italic, Underline,*and*Strikethrough*to apply one or more of these styles to the text or label. Note that some typefaces, such as *Symbol*, do not support bold or italicized text.

- *Bold* will increase the thickness of the text (i.e. **example**).
- *Italic* will create oblique text (i.e. *example*).
- *Underline* will add a horizontal line under the text (i.e. example).
- *Strikethrough* will add a horizontal line through the center of the text (i.e. ~~example~~).

Alignment

The *Alignment* controls the location of the text relative to the reference point. A reference point is the point clicked in the plot window when the crosshair cursor is placing the text on the screen. The text box is horizontally and vertically aligned relative to the reference point. The default position is that the reference point is at the upper left corner of the bounding box (left, top).

- *Left* horizontally aligns the text box so that the reference point is to the left of the text box.
- *Center* horizontally centers the text box on the reference point.
- *Right* horizontally aligns the text box so that the reference point is to the right of the text box.
- *Top* vertically aligns the text box so that the reference point is above the text box.
- *Baseline* vertically aligns the text box so that the reference point is located at the base of the text. The baseline is the imaginary line along which characters are positioned as they are drawn. Descenders on characters, e.g., "tails" in the letters p and q, are drawn below the baseline.
- *Bottom* vertically aligns the text box so that the reference point is below the text box.
- *Center* vertically centers the text box on the reference point.

Text Box Properties

The text object includes background and margin settings in the **Text** properties.

Frame

The *Frame shape* property changes the background shape of the text box from square corners to rounded corners. Select a *Square* or *Rounded* frame shape.

Margin

The *Margin* property sets the padding between the text and the text box frame. Values range between 0 and 1 inches (0 and 2.54 cm) for the *Margin*. To enter a *Margin*, highlight the existing value and type a new value or press the  to increase or decrease the value. Press ENTER on the keyboard to make the change.

Background Line and Fill

Set the background line properties in the *Line* section. Set the background fill properties in the *Fill* section.

Default Settings

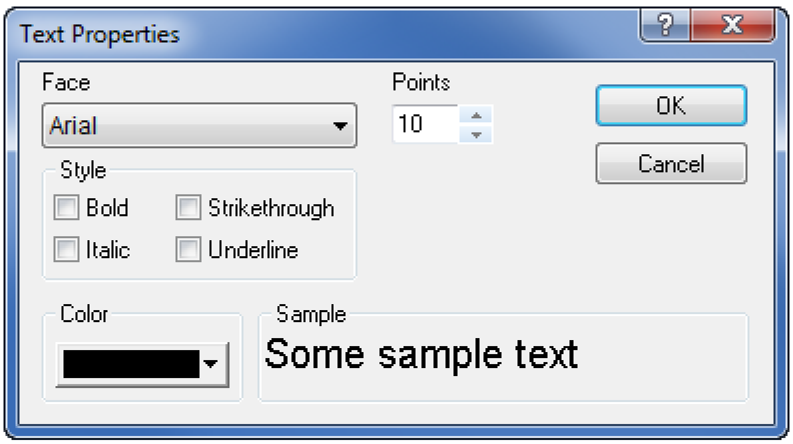
You can set default text properties with the File | Options command. In the **Options** dialog, scroll down to the *Defaults* section and click on the word *Font* to access these defaults. Changes made in the **Options** dialog affect all subsequent documents.

ANSI Translated Using

ANSI encoding contains characters within the first 256 characters of a font. These are normally in English. Select the code page from the list that will read the data correctly. The selected code page is the default language to use with Unicode text. This text option is only available in the **Options** dialog Defaults page.

Font Properties Dialog

When changing some options, a **Text Properties** dialog is displayed. The options are the same as described above in the **Property Manager**. In addition, the **Text Properties** dialog has a *Sample* section where the font can be previewed.

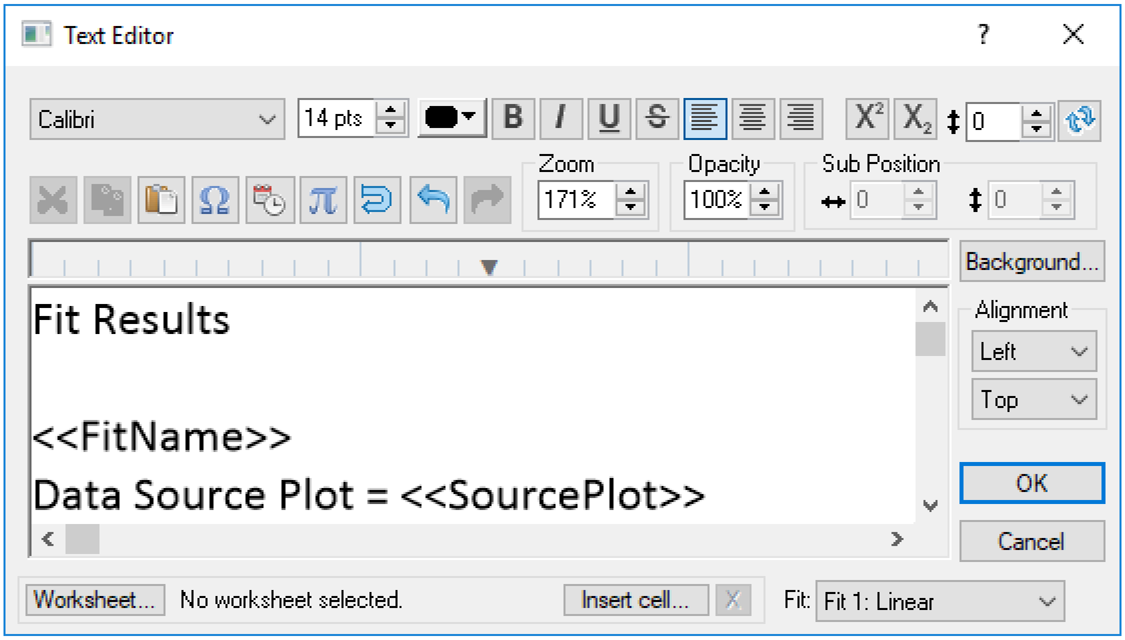


*Set the text properties in the **Text Properties** dialog.*

Text

Text Editor

You can access the **Text Editor** by creating new text or by editing existing text. Type the desired text into the text editor, add templates and symbols, date/time stamps, and apply unique formatting. Add tabs in the **Text Editor** by pressing CTRL + TAB.



*Type or edit text in the **Text Editor**.*

Text Appearance

The top row of tools and buttons change the appearance of currently selected text. Additionally, subsequent text will appear with the selected options.

- Select a typeface from the list in the upper left corner of the dialog.
- Set the size (in points) of the typeface in the box to the right of the typeface list.
- Click the colored button to the right of the size box to display the color palette and change the text color. Click the *Custom* button at the bottom of the color palette to use a custom color.
- Several styles (including bold, italic, underline, and strikethrough) can be applied to the text. Note that some typefaces, such as Symbol, do not support bold or italicized text.
- You can left justify, center, or right justify the text in the bounding box. These options only make a difference with multiple lines of text.
- You can adjust the opacity of the selected text by entering a new number in the *Opacity* box. Enter a value between zero (no opacity, full transparency) and 100% (full opacity, no transparency). You can also set the *Opacity* by clicking the buttons.

Superscripts and Subscripts

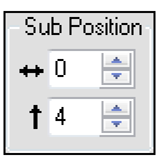
When working with superscripts and subscripts, you can type the character, highlight it, and then click the superscript or subscript buttons. Alternatively, you can click the superscript or subscript button and then type the characters. Click the superscript or subscript button a second time to return to the normal size font and placement.

After clicking the or button, the superscript or subscript will be sized relative to the text immediately preceding it until the **Text Editor** is closed. Superscripts and subscripts are 60% the size of normal text by default. To maintain the relative sizing, select both the normal text and the superscript or subscript and then change the font size. For example, if 'x2' is typed in 10pt font and the '2' is superscripted, the font size for the '2' will be 6pt font, x^2. Next if x^2 is selected and font size is increased to 15pt, the superscript will be size 9pt font, x^2.

If the default superscript or subscript placement is not sufficient, you can highlight the text and enter a number in the character position box to raise or lower text from the midpoint of the existing line. You can also change the character position by clicking the buttons. Click the reset button to reset the highlighted character's position to the default position.

You can click in any field in a template and use the boxes below *Sub Position* to modify the position of the field in a template. The values are offsets from the main character's zero position and are in pixels. How far each value moves the template field is determined in part by the font size. Positive values move the field to the right and up.

Sub Position



You can click in any field in a template and use the boxes below *Sub Position* to modify the position of the field in a template. The values are offsets from the main character's zero position and are in pixels. How far each value moves the template field is determined in part by the font size. Positive values move the field to the right and up. The *Sub Position* values are only available when editing text in a template field.

Editing Tools

Text can be edited using the following tools:

- You can cut , copy , or paste selected text, or paste objects from the clipboard into the **Text Editor**.
- Click the *Insert Symbol* button to open the Symbol Properties dialog and add a symbol to the text block.

- Click the *Insert Date/Time* button to open the Date/Time Format Builder dialog and enter a date and/or time format. The current date and/or time will be updated and displayed in the project every time the **Grapher** project is redrawn.
- Click *Insert Template* button to open the Template Library dialog and enter equations based on a template.
- Click the *Word Wrap* button to wrap lines that extend beyond the user defined line end. Click and drag the word wrap arrow to set the line end. The word wrap can break linked text across lines. Linked text is not displayed when the linked entry is broken by the word wrapping. The arrow can be moved whether word wrap is enabled or not. Often it is easier to specify the word wrap location after zooming out with the *Zoom* field.
- You can undo and redo actions.
- You can magnify text in the **Text Editor** by entering a new number in the *Zoom* box. By default, the text is zoomed to a reasonable level.

Background

Click the *Background* button to open the **Background Color** dialog to set the background line and fill properties for the text box in the **Line/Fill Properties** dialog. The background *Frame shape* can be set to *Square* or *Rounded* in the **Property Manager**Text page.

Text Box Alignment

A reference point is the point clicked on in the view window after clicking the **Home | Draw | Text** command. The text box is horizontally and vertically aligned relative to the reference point. The default position is that the reference point is at the upper left corner of the bounding box (left, top).

- *Right* horizontally aligns the text box so that the reference point is to the right of the text box.
- *Left* horizontally aligns the text box so that the reference point is to the left of the text box.
- *Center* horizontally centers the text box on the reference point.
- *Bottom* vertically aligns the text box so that the reference point is below the text box.
- *Top* vertically aligns the text box so that the reference point is above the text box.
- *Baseline* vertically aligns the text box so that the reference point is located at the base of the text. The baseline is the imaginary line along which characters are positioned as they are drawn. Descenders on characters are drawn below the baseline.

Linking Worksheets to Cells

Grapher allows you to link text objects to worksheet cells.

Click the Worksheet... button to select the worksheet to link the text. Choose a worksheet in the **Open Worksheet** dialog and click the *Open* button.

Click the Insert cell... button to select the cell the worksheet should be linked. Enter a single cell's coordinates in the **Enter Cell** dialog and click the *OK* button. This feature inserts text in the form <<@cell>> where "cell" denotes the cell address. For example, <<@D5>> tells **Grapher** to use the text in cell D5. Multiple cells may be inserted into a single text object.

Use the X button to remove the link between the worksheet and text object. Clicking the X button does not remove any cell text that was inserted into the text object; these entries must be removed manually.

The worksheet text and number format is displayed in the inserted text. To change the format of the linked text, open the worksheet and format the worksheet in the exact format that you want displayed in your text. The linked text will automatically use the same formatting as the worksheet. Some formats, such as color, superscript, or subscript) are not displayed in the linked text.

Linked Text

You may enter unchanging text such as an author name or document date, or you may enter text that updates every time the file is saved. Several types of automatically updating entries may be made in the **Text Editor**, as shown in the following example.

Entry	**Result**
<<filename>>	Displays the full path and file name: c:\Program Files\Golden Software\Grapher 15\Samples\3D pie chart.grf
<<title>>	Displays the document title and extension only: 3D pie chart.grf
<<path>>	Displays the document path only: c:\Program Files\Golden Software\Grapher 15\Samples
<<date/time format>>	Displays any of the predefined date/time formats in the text editor, e.g., <<MM/dd/yy>> would dis-

	play 07/08/09 for July 8th, 2009
<<@cell>>	Displays the contents of the cell from the linked worksheet, e.g. <<@B3>> displays the contents of cell B3.

Inserted Fit Statistics

Fit statistics are also inserted as linked text. To see the fit parameters instead of the linked text command, make sure that the *Fit* option is set in the **Text Editor** before clicking *OK*. Note, this option is only available when inserting fit statistics. To insert fit statistics:

1. Click on the fit curve to select it.
2. In the **Property Manager**, click on the **Plot** tab.
3. Click the next to *Statistics*.
4. Click the *Insert* button next to the *Insert statistics* command.
5. Click on the screen where the text should be located.
6. Double-click on the text to edit the statistics information.

Entry	Result
<<FitName>>	Displays the name of the fit linked to the text
<<SourcePlot>>	Displays the name of the plot to which the fit is applied
<<Equation>>	Displays the equation of the fit linked to the text
<<AltEquation>>	Displays the alternate equation (if any) of the fit linked to the text. When an alternate is not available, the text *No alternate equation* is shown.
<<NumberOfPts>>	Displays the number of points used to calculate the linked fit
<<AvgX>>	Displays the average X value of the linked fit
<<AvgY>>	Displays the average Y value of the linked fit
<<RGSS>>	Displays the regression sum of squares value of the linked fit
<<RMS>>	Displays the residual mean square value of the link fit
<<RSS>>	Displays the residual sum of squares value of the linked fit
<<R2>>	Displays the coefficient of determination for the linked fit. When multiple degrees to a polynomial fit are specified, use <<R2_n>> where

	n goes from 0 to the degree of the polynomial fit.
<<R>>	Displays the correlation coefficient for the linked fit. When multiple degrees to a polynomial fit are specified, use <<R_n>> where n goes from 0 to the degree of the polynomial fit.
<<PolyDegree>>	Displays the degree of the polynomial fit for the linked fit
<<COEFF_n>>	n goes from 0 to the degree of the polynomial fit. The value is the coefficient of the specified degree For histogram fits, displays the location, shape, scale, and Goodness of Fit parameters.
<<XShift>>	X shift value of the orthogonal polynomial fit
<<YShift>>	Y shift value of the orthogonal polynomial fit
<<XScale>>	X Scale value of the orthogonal polynomial fit
<<StdErrX>>	Displays the standard error of the intercept parameter
<<StdErrY>>	Displays the standard error of the slope parameter
<<B_n>>	Displays the B[n] values for the orthogonal polynomial fit. n goes from 0 to the degree of the polynomial fit.
<<Alpha_n>>	Displays the alpha value of the orthogonal polynomial fit. n goes from 0 to the degree of the polynomial fit.
<<Beta_n>>	Displays the beta value of the orthogonal polynomial fit. n goes from 0 to the degree of the polynomial fit.
<<SD>>	Displays the standard deviation of the Gaussian fit.

Resize the Text Editor

To make the **Text Editor** larger or smaller, click and drag on the a corner or edge of the dialog. When the dialog is the desired size, release the mouse button.

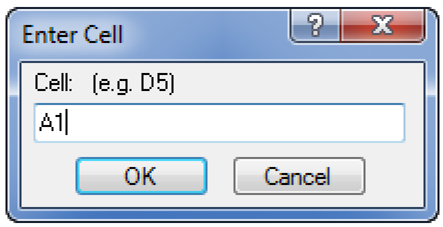
OK or Cancel

Click the *OK* button to save your changes and close the **Text Editor**. Click the *Cancel* button to exit the **Text Editor** without saving your changes.

Enter Cell Dialog

Grapher allows you to link text objects to worksheet cells. To link text to a worksheet cell, click the **Home |Draw | Text** command. In the **Text Editor**, click the Worksheet... button to select the worksheet to link the text. Choose a worksheet in the **Open Worksheet** dialog and click the *Open* button.

Click the Insert cell... button to open the **Enter Cell** dialog.



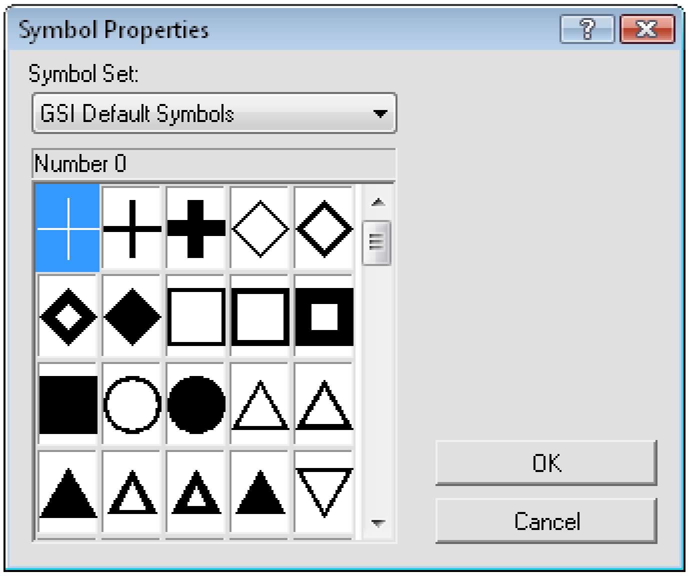
Type the cell location
*in the **Enter Cell**dialog.*

In the **Enter Cell** dialog, type the cell location that should be linked to the text. Enter a single cell's coordinates in the **Enter Cell** dialog and click *OK*. This feature inserts text in the **Text Editor** in the form <<@cell>> where "cell" denotes the cell address. For example, <<@A1>> tells **Grapher** to use the text in cell A1 in the text. Multiple cells may be inserted into a single text object.

Symbol Properties Dialog

The **Symbol Properties** dialog can be used to insert symbols from any font into a text block in the Text Editor or change the symbol for selected objects in the text template.

Symbol properties can be changed for selected objects in the plot window. You can set default symbol properties by clicking the File | Options command. In the **Options** dialog, scroll down to the *Symbol Properties* section to access these defaults. Changes made in the **Options** dialog affect all subsequent documents. Custom symbols can be created using a third party TrueType font editing software.



Specify a Symbol Set *and* Symbol
*in the **Symbol Properties** dialog.*

Symbol Set

The *Symbol Set* displays all the fonts installed on the computer. Click on the symbol set name and then you can choose a new font from the list.

Symbol

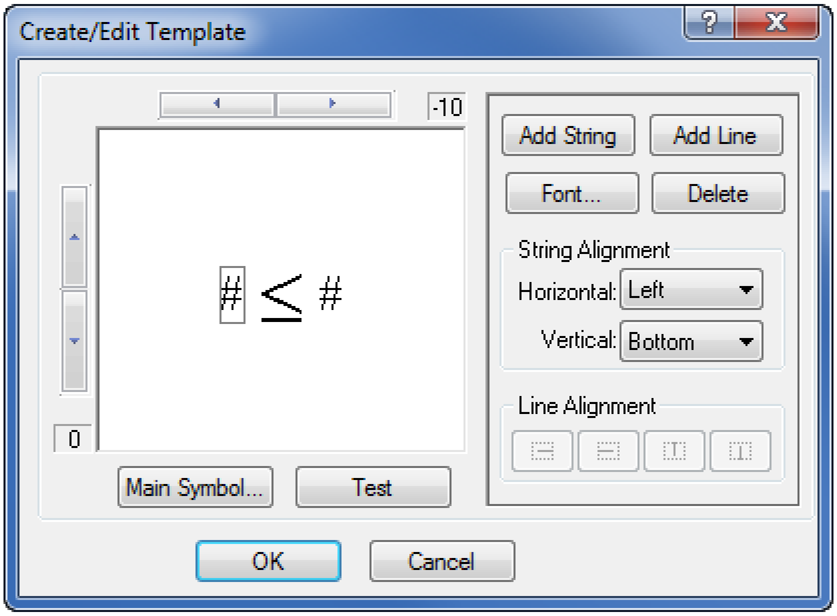
Click on the displayed symbol to choose a *Symbol* from the symbol palette. The number of the selected symbol is indicated in the title bar above the palette and adjacent to the symbol in the Property Manager. Add 32 if you are using font sets or TrueType symbols, such as GSI Default Symbols.

The symbol index is the symbol or glyph number as it appears in the title bar above the palette and adjacent to the symbol in the **Property Manager**. This is the 0-based offset of the symbol within the symbol set. You can use the Window's Character Map utility to determine the ASCII code for font symbols.

Create/Edit Template

The **Create/Edit Template** dialog allows you to create template designs. To add custom templates to the Text Editor's template library, click the *New* button in the Template Library dialog. To edit an existing template, select the template and click the *Edit* button.

If you are creating a new template, select a symbol and click *OK* before the **Create/Edit Template** dialog opens.



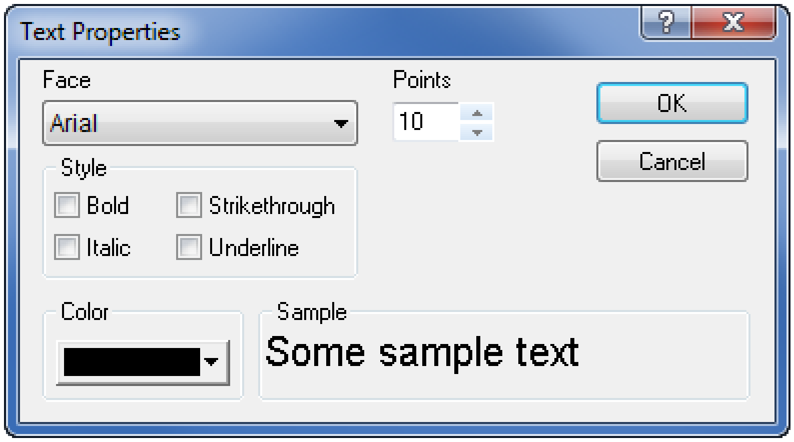
*Use the **Create/Edit Template** dialog to create new templates or edit existing templates from the template library.*

Arrow Buttons
Click the arrow buttons on the left and top sides of the dialog to position a string or a line. The numbers at the edge of the arrow buttons show the string location.

Add String
Click the *Add String* button to add a text string box. Text string boxes in the templates allow numbers or letters to be entered into the template in the **Text Editor**.

Add Line
Click the *Add Line* button to add a line to the template.

Font
Select a text string (#) and click the *Font* button to open the **Text Properties** dialog and set the properties of the text string.



Set the properties of the text string in the ***Text Properties*** *dialog.*

Delete
Select a text string or a line, and then click the *Delete* button to remove it from the template.

String Alignment
Once a text string is created (#), you can set the *String Alignment* of the entered text. Text is entered after the template has been inserted into the text editor. Refer to the **Text Box Alignment** section of the Text Editor topic for more information on alignment.

Line Alignment
You can set the *Line Alignment* to extend to the right, left, top, or bottom of the marker by selecting a line and clicking one of the *Line Alignment* buttons. The line length depends on the bounding box size.

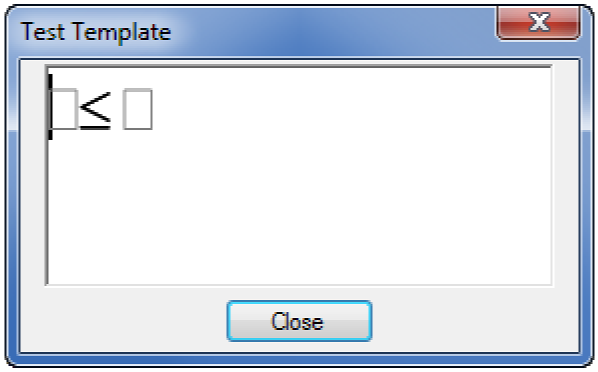
Use the Line Alignment *buttons.*

Main Symbol
Click the *Main Symbol* button open the Symbol Properties dialog and change the main symbol appearing in the template.

To delete the main symbol, click the *Main Symbol* button to open the **Symbol Properties** dialog. Choose an empty symbol box, such as symbol number zero.

Test

Click the *Test* button to open the **Test Template** dialog and see how the template will appear in the **Text Editor**.



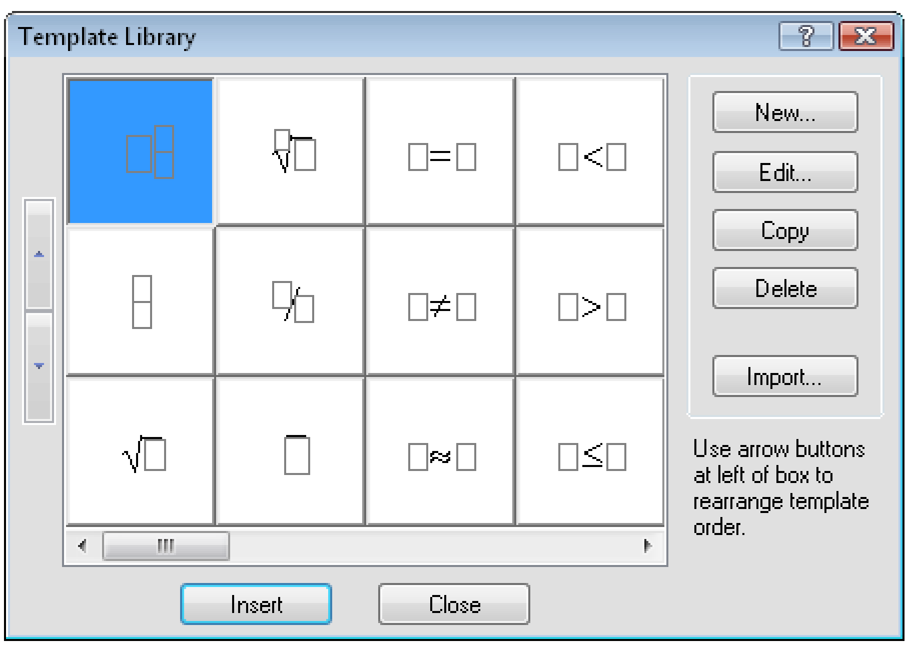
*The **Test Template** dialog displays how the template will appear in the **Text Editor**.*

Template Library

You can use text templates from the **Template Library** to add equation formats into the Text Editor.

Template Library Dialog

Click the button in the **Text Editor** dialog to open the **Template Library** dialog.



*Use the **Template Library** dialog to insert templates that an be used to input equations into the**Text Editor**.*

Up/Down
Use the up and down buttons at the left side of the screen to reposition a selected template in the library.

New
Click the *New* button to create a new template. The Symbol Properties dialog opens. Select a base symbol, click *OK*, and the **Create\Edit Tempate** dialog appears.

Edit
Click the *Edit* button to edit the selected template in the **Create\Edit Template** dialog.

Copy
Click the *Copy* button to duplicate the selected template. The copied template is automatically pasted at the end of the template library.

Delete
Click the *Delete* button to delete a template.

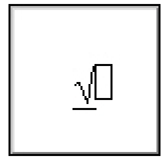
Import
Click the *Import* button to use a different Golden Software template library file [.LBT].

Insert
Click the *Insert* button to insert a template into the **Text Editor**.

Close
Click the *Close* button to close the template library without inserting a template into the **Text Editor**.

Example
For example, to use the **Template Library** to create an image of the square root of a number:

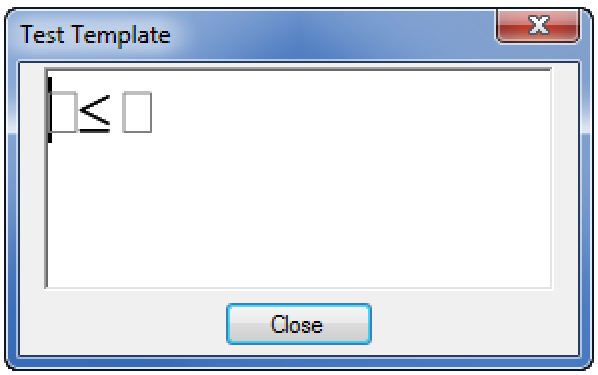
1. Click the **Home | Draw | Text** command.
2. Click on the plot window where you want the text to be displayed.
3. In the **Text Editor** dialog, click the button.

4. In the **Template Library** dialog, select the  template and click the *Insert* button.

5. In the **Text Editor**, the template is inserted as $\sqrt{\square}$. Enter the numeric value, for example the number nine, and click *OK* to display the $\sqrt{9}$ text in the plot window.

Test Template

Click the *Test* button in the Create/Edit Template dialog to see what the final template will look like without the string and line symbols.



*The **Test Template** dialog displays the final template.*

Template Editor Example

When creating complex equations text, it is sometimes necessary to create one or more templates to create the equation. Once the templates are created, they can be inserted into the text box. Templates can be embedded within other templates. The following example contains two templates, the square root template and the division template.

Example 1 - Square Root Template

This example creates a square root template to be used in the second example.

1. Open the Text Editor by creating new text or by editing existing text. You can use the Property Manager to edit existing text.
2. Click the button in the **Text Editor** to open the Template Library dialog.
3. Click the *New* button in the **Template Library** dialog.
4. In the **Symbol Properties** dialog, choose the square root symbol for the main symbol, and then click the *OK* button. The square root symbol is number 182 near the bottom of the *Symbol* typeface.
5. Click *Add String* in the Create/Edit Template dialog and a pound symbol appears.
6. Set the *Horizontal String Alignment* to *Left* so the top line will grow with the text entered into the box.
7. Use the arrow buttons on the left and top sides of the dialog to position the string to the right of the square root sign.
8. Click the *Add Line* button.
9. The button (extending right) should be selected in the *Line Alignment* group box.
10. Use the arrow buttons to position the line above the string and to the upper right side of the square root sign.
11. Click the *Test* button to view the final template.
12. Click the *OK* button to add the template to the template library. Leave the **Template Library** dialog open for the next example.

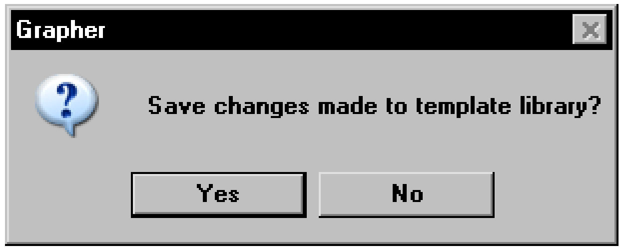
Example 2 - Division Template

This example uses the square root template created in the first example.

1. Click the *New* button in the **Template Library** dialog.
2. In the **Symbol Properties** dialog, choose the empty symbol for the main symbol, then click the *OK* button. The empty symbol is number zero in the *Symbol* typeface.
3. Click *Add Line* in the **Create/Edit Template** dialog.
4. The button (extending right) should be selected in the *Line Alignment* group box.
5. Click *Add String*.
6. Use the arrow buttons at the left and top side of the dialog to position the string above the line, and to the right of the line symbol.
7. Click *Add String* again.
8. Use the arrow buttons at the left and top side of the dialog to position the string below and to the right of the line symbol.
9. Click the *Test* button to view the final template in the **Test Template**dialog.
10. Click the *Close* button to close the **Test Template**dialog. Click*OK*to

close the**Create/Edit Template**dialog and add the template to the template library.

11. Click the *Close* button to close the **Template Library** and return to the **Text Editor**. After clicking the *Close* button, the following dialog appears:



***Grapher** gives you the option to save template library changes.*

12. Click the *Yes* button if you want to keep the new templates that you have created. Click the *No* button if you want to delete the new templates.

Using Multiple Templates

Once the templates have been created, they can be inserted into the **Text Editor**. Templates can be inserted into other templates. To create the dividing/square root equation:

1. In the **Text Editor**, click the button to open the **Template Library**.
2. Click the new square root template in the **Template Library**, and then click the *Insert* button. The square root symbol appears in the **Text Editor**.
3. Click inside the text box underneath the square root sign.
4. Click the button again.
5. Click the new division template in the **Template Library**, and then click the *Insert* button. The division template is inserted under the square root sign.
6. Click in the numerator box and type the letter X.
7. Click in the denominator box and type the number 2.

Once the text is entered into the templates, the substrings (added lines or added symbols) can be moved around. For example, the top line on the square root symbol may not quite touch the square root. Select the line by clicking just to the left of the line where the pound sign (#) would be in the **Create/Edit Template** dialog. Use the *Sub Position* boxes in the **Text Editor** to move the line around.

Math Text Instruction Syntax

The math text instruction set offers advanced formatting of text labels from the worksheet in **Grapher**. Math text instructions can be used to change the typeface, size, color, weight, and style of text on a character-by-character basis. Greek letters and mathematical symbols can be written using math text instructions. The math text instructions also allow for the detailed placement of characters and symbols; thus, superscripts, subscripts, and the superposition of characters are possible. The worksheet cells used as post labels in a post plot can contain math text instructions. In general, the clipboard can be used to cut and paste math text instructions.

Do not use math text instructions in the **Text Editor** as the Text Editor cannot use math text instructions. To use different text properties in the **Text Editor**, highlight the text to change and click the appropriate button or command in the dialog.

Unless otherwise indicated, all math text instructions begin with a backslash ("\"), and end with a single space. For example, the instruction "`\up50 `" shifts the baseline of the text up 50 percent of the current text height. All characters from the beginning backslash through the ending single space are interpreted as instructions by the math text interpreter, and are not included in the resulting label.

Each line in a text block starts with the default text properties such as typeface, size, color, and style. (Note that some typefaces, such as Symbol, do not support bold or italicized text.) A line of text within a text block uses the current properties until a math text instruction is encountered. All text following an instruction is modified according to the instruction. For example, if the typeface is changed in the middle of a text string, the text following the instruction will use the new typeface until the end of the line of text is reached, or until another instruction affecting the typeface is encountered.

Encapsulate Math Text Instruction

Math text instructions can also be encapsulated so they are not carried out over an entire line. A left curly brace ("{") instructs the math text system to remember all of the text properties in effect at that point. A right curly brace ("}") restores the properties to what they were at the matching left curly brace. This allows the insertion of special text in the middle of an otherwise uniform text block. The only instructions this does not apply to are text baseline instructions (`\dnX` and `\upX`), and the position instructions (`\rpX` and `\spX`). Curly braces can be nested.

To incorporate a backslash, right curly brace, or left curly brace as a text character in a text block, precede them with a backslash when entering the text string. For example, "\\" produces "\", and "\{" produces "{".

Percentage Instructions

Instructions based on a percentage, such as font size, are cumulative. This means that a second percentage change within a text block is interpreted as a percentage of the first percentage change. For example, if the font is scaled by 50%, and later in the same text block the font is scaled by 50% again, the font size after the second percentage would be 25% of the original font size.

- Instruction names are case insensitive (`\fs50`, `\FS50`, `\Fs50` or `\fS50` are all valid).
- The `\sp` and `\rp` instructions only refer to positions on the same line.

Instructions that Change Typefaces, Sizes, and Styles

Math Text Instruction	Result
\b	All text after the `\b` command is bold.
\f"X"	Change to the typeface named X. These are the names listed in the Face drop-down list box in the **Text**dialog in the plot window. Typeface names are case sensitive. Enclose the face name in double quotes. If the typeface is not found, a generic stick typeface is used in place of the unfound typeface.
\fsX	Change font size to X% of current font size. For example, a value of 200 for X increases the font size by two, and a value of 50 for X decreases the font size by one-half.
\i	All text after the `\i` instruction is italicized.
\plain	This sets the text to "plain" text with normal weight, no italics, no underlining, and no strikethrough.
\strike	Strikethrough the text.
\ul	All text after the \ul instruction is underlined.

Instructions that Change Text Color

Math Text Instruction	Result
The following instructions are provided to make it easy to set basic text colors:	
\black	Sets the text color to black.
\blue	Sets the text color to blue.
\green	Sets the text color to green.
\cyan	Sets the text color to cyan.
\red	Sets the text color to red.
\magenta	Sets the text color to magenta.
\yellow	Sets the text color to yellow.
\white	Sets the text color to white.
\gray	Sets the text color to gray.
The following instructions allow the text color to be set to an arbitrary RGB (Red,Green,Blue) value:	
\rgbrX	Sets the amount of red in an RGB text color (X=0 to 255).
\rgbgX	Sets the amount of green in an RGB text color (X=0 to 255).
\rgbbX	Sets the amount of blue in an RGB text color (X=0 to 255).
\rgbaX	Sets the alpha value in the RGBA text color (X=0 to 255).
\color (r,g,b,a)	Sets the amount or red, green, blue, and alpha value in the RGBA text color. r, g, b, and a are all a value between 0 and 255.

Instructions that Change Text Position

Math Text Instruction	Result
\dnX	Moves text baseline down X% of current font size (subscript). This instruction produces subscripts or returns the baseline to the original position following a \upX instruction. If a font size (\fsX) instruction follows the \dnX instruction, any subsequent \dnX or \upX instructions are relative to the changed font size.
\n	Creates a new line in the text block. This works similar to a carriage return - line feed combination. This should be

	used instead of the \dnX to create a new line of text.
\rpX	Restores the current position to position #X (X = 1 to 20). This instruction is used in conjunction with the \spX instruction. Any text following this instruction begins at the position defined with the \spX instruction. If the \rpX instruction is used without first setting a position with the \spX instruction, the position for the text is returned to the stating position for the text block.
\spX	Saves the current position as position #X (X = 1 to 20). The position is the up, down, left, and right areas within the text block. When the \spX instruction is used, the current location within the text block is assigned a position number. Return to this position using the \rpX instruction. Specify the position number assigned with the \spX instruction when using the \rpX instruction. These instructions are most useful when placing both superscript and subscripts after the same character.
\upX	Moves the text baseline up X% of current font size (superscript). This instruction is used to produce superscripts or to return the baseline to the original position following a \dnX instruction. If a font size (\fsX) instruction follows the \spX instruction, any subsequent \upX or \dnX instructions are relative to the changed font size.

Instructions Used to Insert Special Characters or Date and Time

Math Text Instruction	Result
\aX	Insert a character whose decimal code number is given by X (0 to 65535). In older non-Unicode aware software, this instruction is needed for characters with code numbers beyond the normal limits of the keyboard. For example, use the character code number to include an integral sign in a text string

	by specifying the character set, followed by the \aX command to specify the correct character number. For example, an integral sign is located at code position 242 in the symbol set called Symbol. Type \f"Symbol" \a242 for the integral sign to appear in the text block. The Character Map program is an accessory program in the Windows installations. Use the Character Map to display each of the available character sets and their designated code numbers. The code number is displayed in the right half of the Character Map status bar when a character is selected. In newer Unicode aware software, the need to use this directive occurs less often as one can simply copy/paste the letters or symbols needed from Character Map or any other Unicode aware software. Even if the character doesn't appear on your keyboard, can be entered by holding down the Alt key while typing the four digit hexadecimal code number for the special symbol you desire. See the Microsoft Windows documentation for further details.
\date	Inserts the current date. Be sure to follow this instruction with a space, even if no other text follows the date. The date is updated every time the text is redrawn.
\time	Inserts the current time. Be sure to follow this instruction with a space, even if no other text follows the date. The date is updated every time the text is redrawn.
\dt ("format")	Inserts the current date and/or time as indicated by a custom format string. Be sure to follow this instruction with a space, even if no other text follows the closing parenthesis. The date and or time is updated every time the text is redrawn.

Examples of Math Text Instructions

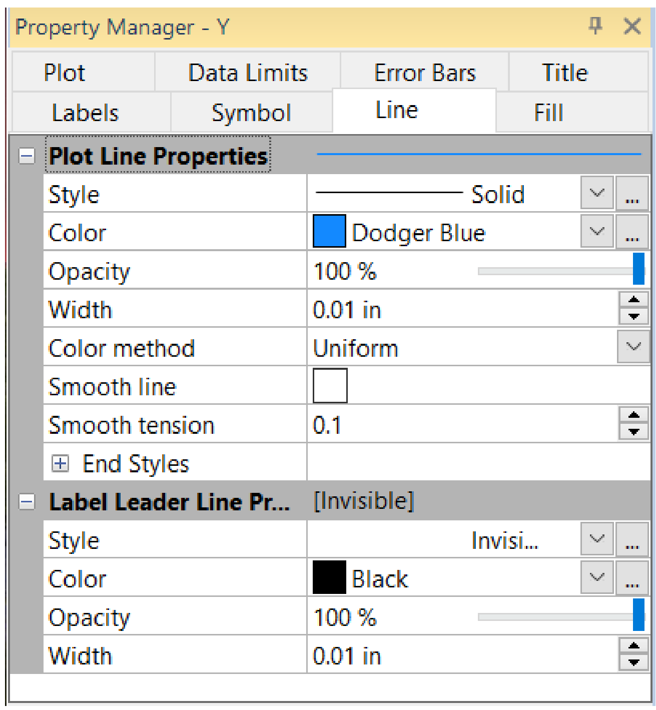
Due to page size limitations, some of these examples contain multiple lines of math text instructions. These examples must be entered on one line for the text to be displayed correctly.

Math Text Instruction	Result
CO\dn50 2	CO_2
x\up50 2	x2
\sp1 {\fs200 \f"Symbol" \a229 \sp2 }{\rp1 \dn90 \fs75 i=1\rp1 \up220 n}\rp2 \up25 X\dn50 {\fs75 i}\up50 Y\dn50 {\fs75 i}\up50 = S {\dn50 {\fs75 XY}\up50 }	$\sum_{i=1}^{n} X_i Y_i = S_{XY}$
{\i Avogadro} Constant = 6.022 x 10{\up50 {\fs75 23}\dn50 }	*Avogadro* Constant = 6.022 x 1023
{\f"Symbol" \a209 } {\up50 {\fs50 2}\dn50 } {\f"Symbol" \a102 } = {\f"Symbol" \a182 } {\up50 {\fs50 2}\dn50 } {\f"Symbol" \a102 }/ {\f"Symbol" \a182 }x {\up50 {\fs50 2}\dn50 } + {\f"Symbol" \a182 } {\up50 {\fs50 2}\dn50 } {\f"Symbol" \a102 }/ {\f"Symbol" \a182 }y {\up50 {\fs50 2}\dn50 }	$\nabla^2\phi = \partial^2\phi/\partial x^2 + \partial^2\phi/\partial y^2$
{\fs200 N}\sp1 \up100 \fs75 5 \rp1 \dn50 1	N_1^5
sin{\up50 {\fs50 2}\dn50 }(X) + cos {\up50 {\fs50 2}\dn50 } (X) = 1	$\sin^2(X) + \cos^2(X) = 1$
104\f"Symbol" \a176 \f"Arial" 37'	104°37'
a\dn25 {\fs75 c} \n ___ \n b\dn25 {\fs75 c}	$\frac{a_c}{b_c}$
{\f"Symbol" d}\up50 {\fs75 234}\dn50 U	$\delta^{234}U$

Line Properties

Line properties can be changed for selected objects. To edit the line properties, click on the object in the Object Manager or plot window. The properties are listed in the Property Manager on the **Line** tab.

The **Line** page in the **Property Manager** contains properties for all lines in the object. For example, a line/scatter plot **Line** page will include a *Plot Line Properties* section. The **Line** page will also include a *Label Leader Line Properties* section. The **Line** page for an axis can contain four sections: *Axis Line Properties*, *Ticks Line Properties*, *Grid Line Properties*, and *Label Leader Line Properties*.



*Set the line properties in the **Property Manager** on the **Line** tab.*

Sample

The sample of the line is displayed next to *Line Properties*. The sample shows the line style, color, opacity, and width options.

If the *Line Properties* section is closed, click the ⊞ next to *Line Properties* to open the section.

Style

The *Style* is the manner in which a line is drawn. To change the *Style,* click on the existing line next to *Style.*Theline style palette opens. Click on a style to use it for the selected line. To create a custom line style, click the button at the right of the line style to open the Custom Line dialog, where you can create new line styles.

3D lines do not support the complex line styles. The standard line styles and custom line styles can still be used with 3D lines.

Color

The *Color* is the color of the line. Click the existing color sample next to *Color* to open the color palette. Click on a color in the palette to use it for the selected line. To create a custom color, click the button at the right of the color sample to open the Colors dialog.

Opacity

The *Opacity* controls the transparency of the line. To change the *Opacity*, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click and drag the to change the opacity percentage. Opacity values are between 0% (zero opacity, full transparency) to 100% (full opacity, zero transparency).

Width

The *Width* controls how a line appears. To change the line *Width,* highlight the existing value and type a new number. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the thickness of the line. The line *Width* is a value from 0.0 to 0.5 inches (0.0 to 1.27 cm). A width of zero is one pixel wide. Values are in page coordinates.

Line Color Method

Colors can be applied to lines in various ways. The *Line color method* property defines which method is used to color the line:

- *Uniform*, where one color is used for the entire line
- *Color variable*, where line segment colors are specified by a color variable.
- *Colormap*, where the color is varied along the line by a color gradient.

Color Variable

When *Color variable* is selected, the *Color variable* is a column/row in the worksheet that contains a color specification. The color of the line segment changes based on the color in the worksheet column. The line color stays the selected new color until another color change is specified. To change the *Line color variable*, click the existing column or the word *None*. Select any other column in the worksheet.

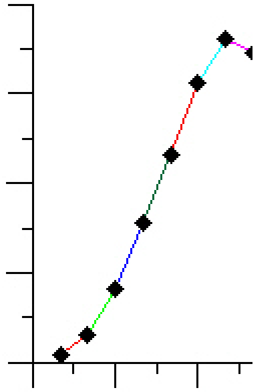
Colors can be specified in the worksheet by many different methods.

Method	Example
<color>	Red
<color>:<a>	Red:255
RGB(<r>,<g>,<b>)	RGB(255,0,0)
\COLOR(<r>,<g>,<b>,<a>)	\COLOR(255,0,0,255)
R<r> G<g> B<b>	R255 G0 B0
R<r> G<g> B<b> A<a>	R255 G0 B0 A255
\RGBR<r> \RGBG<g> \RGBB<b>	\RGBR255 \RGBG0 \RGBB0

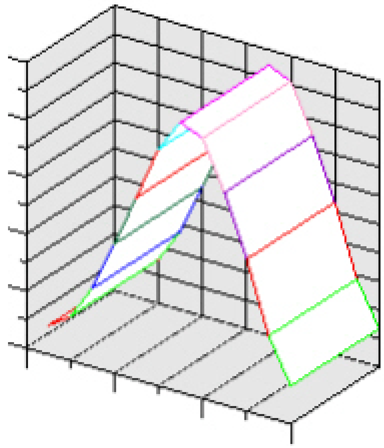
where <r>, <g>, <b>, and <a> are red, green, blue, and alpha values between 0 - 255 and <color> is a color name as it appears in the color palette.

Colormap

When *Colormap* is selected, the colormap is a color gradient that is distributed along the line from the first vertex to the last vertex. Select the desired color gradient in the *Colormap* property field.



This Line/Scatter Plot uses a Line color column *in the worksheet to change the color of the line segments.*



This 3D Ribbon/Wall plot uses a Line color column *in the worksheet to change the color of the line segments.*

End Styles

The ends of the lines can have arrowheads on them. To open the *End Styles* section, click the next to *End Styles*. Some lines, for example 3D axis grid lines, do not support end styles.

The *Start* style is placed at the first vertex of the line. The *End* style is placed at the last vertex of a line. Not all lines can have arrowheads. For example, the line surrounding a rectangle does not support arrowheads. To change the *Start* or *End* style, click on the current option and select the desired option from the list.

The *Scale* determines the size of the arrowhead. A larger *Scale* creates a larger arrow. To change the scale of the arrowheads, highlight the existing value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, click the to increase or decrease the scale. A value of 1 makes the arrow the default size.

Draw Arrows

The arrow on a 3D vector plot is displayed by default. The arrow can be turned off by unchecking the box next to the *Draw arrows* option. This option is only available for 3D vector plots. When checked, the arrow is displayed. When unchecked, the arrow is removed.

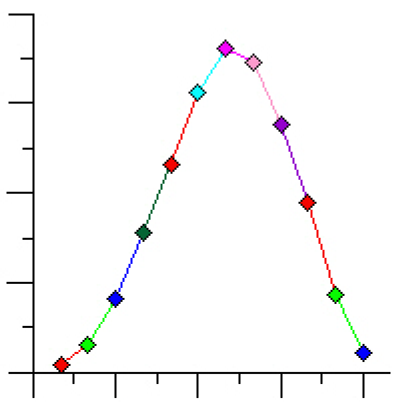
Smooth Line

Select the *Smooth line* option to spline smooth the connecting line in the line plot. Control the amount of smoothing by entering a value between 0 and 1 in the *Smooth tension* field. The smaller the *Smooth tension* value, the more curved the connecting line. You may need to increase the tension if your line plot has areas where the line crosses itself. Clear the *Smooth line* option to connect data points with a straight line. The smoothing may not be visible if a *Line color column* is selected.

Use Color For Symbols

When the *Line color column* is specified, the *Use color for symbols* option is available. Symbols use the same color as the *Line color column* when the box next to *Use color for symbols* option is checked. The color of the symbol is changed on the row where the symbol occurs. The symbol is the same color as the line that follows the symbol.

If the *Symbol table* option is selected on the **Symbol** tab, the colors are read from the symbol table and not from the *Line color column.*



This is the same Line/Scatter plot as above, with the Use color for symbols *option checked.*

Color Scaling

On a vector plot, polar vector plot, or 3D vector plot, check the box next to *Color scaling* to set the color of the vector based on the vector length. Set the colors to use for the vectors with the *Colormap* option. When the *Color scaling* option is unchecked, the *Color* option sets the color of all vectors.

Show Color Scale

On a vector plot, polar vector plot, or 3D vector plot, check the box next to the *Show color scale* command to show the vector map's color scale. Note: this option is disabled if the *Color scaling* box is not checked.

Colormap

The *Colormap* option sets the vector colors to be set from a color gradient. Click the existing color gradient and select the desired color gradient from the list. Click the ... button next to the color gradient to open the Color Gradient dialog. The *Colormap* option is disabled if the *Color scaling* option is not checked.

Surface Mesh Lines

Surface data maps, surface grid maps, and surface function maps can include a wireframe mesh on the surface represented by lines of constant X and lines of constant Z. The line properties are controlled independently in the *X mesh lines* and *Z mesh lines* sections.

Frequency

The *Frequency* defines how many mesh lines are shown on the surface map. This value must be equal to or greater than 1. The *Frequency* displays a line at every nth grid row or column. For example, a*Frequency* of 1 displays a line at every grid row or column and a *Frequency* of 3 displays every third line. To change the *Frequency*, highlight the current value and type a new value. Press ENTER on the keyboard to make the change. Alternatively, press the to increase or decrease the step value.

Line Properties

Edit the line properties for the mesh lines in the *Line Properties* section.

Axis Tick Line Properties

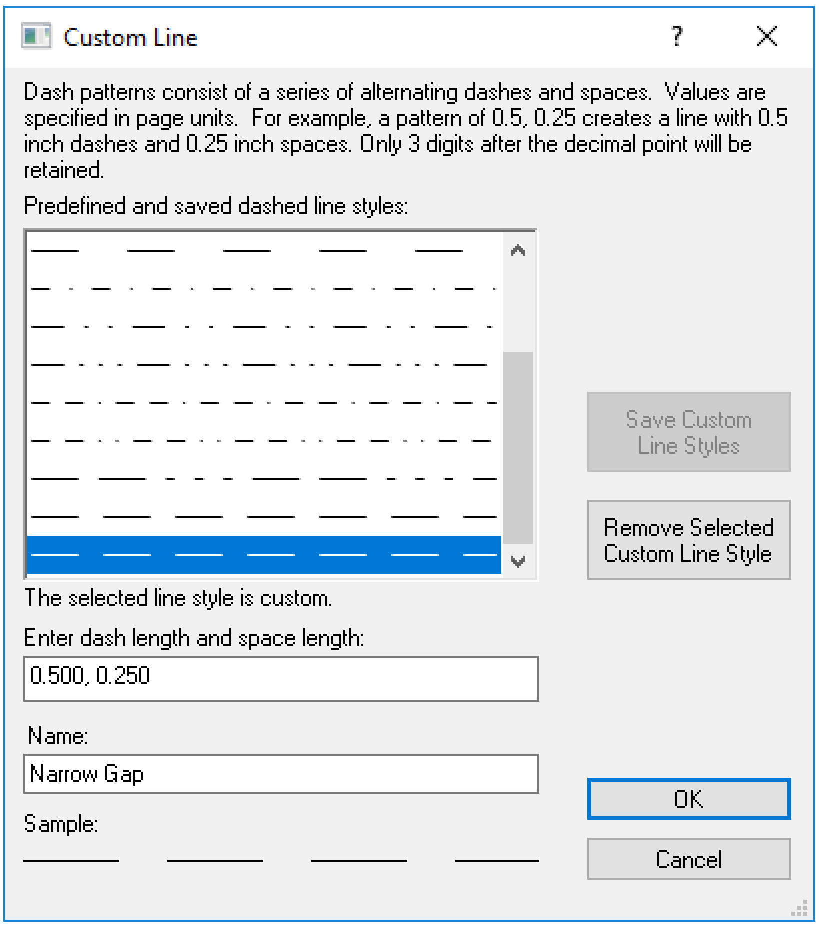
By default, tick marks have the same line properties as the axis line. Therefore, changing the axis line properties in the *Axis Line Properties* section also changes the tick mark line properties. You can override this setting and define unique line properties for the tick marks by setting the *Major tick line* and/or *Minor tick line* option to *Custom* and then setting the line properties in the following *Major tick line properties* or *Minor tick line properties* sections. To open sections, click the ⊞ next to the section name.

Default Line Properties

You can set default line properties through the File | Options command.

Custom Line Style

Click the ... button to the right of the selected line style to open the **Custom Line** dialog and create new line styles. You can add line styles to the palette, remove line styles from the palette, or replace existing line styles in the palette.



Use the ***Custom Line*** *dialog to add line styles to the palette, remove line styles from the palette, or replace existing line styles in the palette.*

Dashes and Spaces

The *Enter dash length and space length* box determines the pattern of the custom line.

As an example, refer to the custom dash line style shown above. A pattern of 0.5, 0.25 will create a line with .5 inch dashes and .25 inch gaps. The pattern repeats the dash pattern and is displayed in the Sample box.

Enter a single value into the *Enter dash length and space length* box to create a dashed line with equally sized dashes and spaces.

Name

Click on one of the displayed line styles and the name of the selected line style appears in the *Name* field. Type a new line style name in the *Name*field if you are creating a custom style.

Sample

The *Sample* box shows the new line style.

_ _ _ _

Save Custom Line Styles

Click *Save Custom Line Styles* to add the new line style to the end of the line palette. Type the new line style name into the *Name* field before adding the new line style. This makes the custom line styles available in all **Grapher** sessions.

Remove Selected

Click R*emove Selected Custom Line Style* to delete the selected line style. Predefined line styles cannot be removed.

Line Style Palette

The line style palette at the top of the dialog shows all line styles.

OK or Cancel

Click *OK* to make the change. The line will use the line style defined in the **Custom Line** dialog in this **Grapher** project. If you wish to keep the line style available every time you use **Grapher**, click the *Save Custom Line Styles* button.

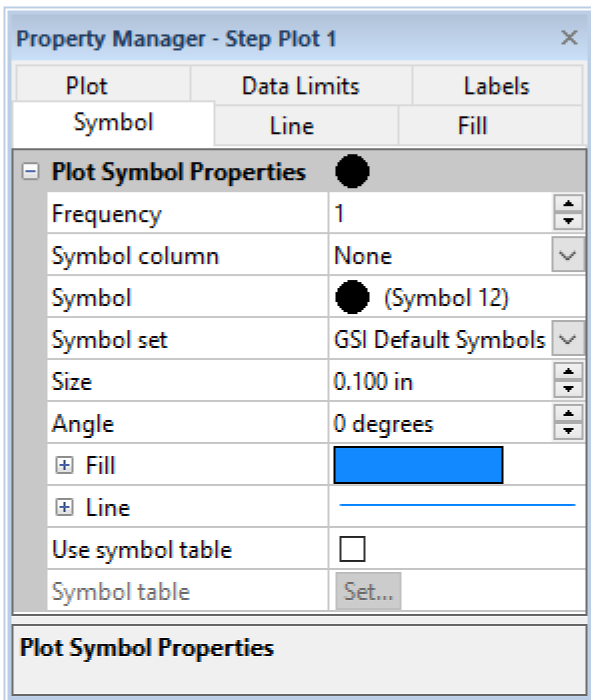
Click *Cancel*to close the**Custom Line**dialog without making any changes.

Symbol Properties

Symbol properties can be changed for selected objects in the plot window. You can set default symbol properties through the File | Options command. In the **Options** dialog, click on *Symbol* in the *Defaults* section to access these defaults. Changes made in the **Options** dialog affect all subsequent documents. Custom symbols can be created using a third party TrueType font editing software.

To change the symbol properties on a plot, click on the plot in the Object Manager or the plot window to select it. The plot properties are displayed in the Property Manager.

The **Symbol** page in the **Property Manager** contains the properties for all symbols in the plot. For example, a line/scatter plot **Symbol** page will include a *Plot Symbol Properties* section. If average value error bar symbols are displayed, then the **Symbol** page will also include an *Average Value Symbol Properties* section.



*The symbol properties are set in the **Property Manager** on the **Symbol** tab.*

Symbol Frequency

The *Frequency* option allows you to specify how often a symbol appears on the plot. For example, set the *Frequency* value to 2 to display a symbol at every other data point on a graph. Change the *Frequency* value to 3 to display a symbol at every third data point on the graph. To change the

Frequency, highlight the existing value and type a new number. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the value. The *Frequency* can be any number between 0 and 2147483647. The plot automatically updates to show the new frequency.

Symbol Column

The *Symbol column* option allows you to select symbols from a specific column in the worksheet. To select a *Symbol column*, click on the current column name or the word *None* and select the desired column from the list. When the *Symbol column* is set to *None*, all symbols in the plot are controlled by the **Symbol** properties page.

The values in the worksheet symbol column can have three forms:

- *Symbol set:Index* displays a symbol from a specific symbol set. The *Symbol set* is the font from which the symbol is selected. The *Index* is the symbol's index number in the font. For example, the cell value *Arial:87* in the worksheet would make the symbol a lowercase "w" in the Arial font in the plot.
- *Index* displays a specific symbol from the symbol set specified in the *Symbol set* field in the **Symbol** page. The default symbol set is *GSI Default Symbols*. For example, a cell value of *12* in the worksheet would set the symbol to a filled circle if the *Symbol set* is set to *GSI Default Symbols* in the **Property Manager**.
- An empty cell displays the symbol specified by the *Symbol* and *Symbol set* properties in the **Symbol** page.

The symbol index value is the symbol number as it appears in the **Symbol** properties *Symbol* field. This is the 0-based offset of the symbol within the symbol set. To use the symbol index in a data column, use the value displayed in the **Symbol** properties. The symbol index value is the ASCII code minus 32. For example, the ASCII code for the Arial font uppercase A is 65. The index value displayed in the symbol properties and used in the symbol column is 33.

You can use the Windows character map utility to determine the ASCII code for font symbols, and you can then subtract 32 from the ASCII code to determine the index value. However, it is generally faster to obtain the index value directly from the **Symbol** page *Symbol* property. Note that the character map utility displays ASCII codes in hexadecimal. For example U+0041 is displayed in the Windows Character Map for uppercase A. Convert the hexadecimal value 0x41 to a decimal value: 4 x 16 + 1 = 65. This value, 65, is the ASCII code in decimal notation. The Index value is 33 (65 - 32 = 33).

Symbol

The *Symbol* is the symbol that is displayed on the plot when the *Symbol frequency* value is greater than 0. To change the *Symbol*, click on the existing symbol. The symbol palette is displayed. Click on the new symbol. The plot is automatically updated to show the new symbol.

The symbol number is indicated in the title bar above the symbol palette and adjacent to the *Symbol* in the Property Manager. The symbol number is the 0-based offset of the symbol within the symbol set. The symbol number is used in a column when the*Symbol column*option is enabled.

Symbol Set

The *Symbol set* displays the font that is currently used for the symbol. To change the *Symbol set*, click on the existing symbol set name. In the list, select a new font from the list. All TrueType fonts are listed in the *Symbol set*.

Size

The *Size* controls the symbol size. This is the size of the full symbol box, not just the symbol. To change the *Size* of the symbol, highlight the existing value and type a new number in the box. Alternatively, click on the  to increase or decrease the size of the symbol. Symbol sizes are between 0.0 and 4.0 inches (0.0 and 10.16 centimeters) and are shown in page units.

Note that the symbol *Size* is affected by the line *Width* setting. When you change the *Size* value only the symbol size changes. However if you deselect the symbol and select the object again, the *Size* value updates automatically to display the symbol *Size* value plus the line *Width* value, i.e. the overall size of the symbol. Consider the two following examples: You desire a symbol *Size* of 0.200 inches with a line *Width* of 0.005 inches. If you enter these values into the respective property fields, the overall symbol size will be 0.205 inches. Now you desire a symbol with a line width of 0.005 inches and overall symbol size of 0.200 inches. Then you must enter 0.195 in the *Size* field and 0.005 in the *Width* field. The overall symbol size will be 0.200 inches.

Symbol Angle

The *Angle* property controls the symbol rotation. Enter a value between -360 and 360 to rotate the symbol. Positive values rotate the symbol counterclockwise, and negative values rotate the symbol clockwise. The *Angle* is specified in degrees. To change the *Angle*, highlight the existing value and type a new number. Press ENTER on the keyboard to make the change. Alternatively, click on the to increase or decrease the rotation value.

Fill Properties

The *Fill* controls the inside color, opacity, and pattern of the symbol, when the selected symbol is a filled symbol. To change the *Fill* properties of the symbol, click the next to *Fill* to open the *Fill* section. Set the *Pattern, Foreground color, Foreground opacity, Background color, Background opacity, Stretch,* and *Scale* for the inside portion of the filled symbol. Refer to the Fill Properties page for information about the various fill options.

Note that 3D plots do not support symbol fill properties. A *Color* and *Opacity* option are available to control the symbol color and opacity for 3D symbols.

Fill Color Column

Symbols can be assigned fill colors from a data color column. Select the color column in the *Color variable* list to apply symbol fill colors from the worksheet. The fill style is automatically set to *Solid* when a *Color variable* is used.

When the selected color variable includes numeric data, the data are mapped to a color gradient and the color mapping is applied to the symbols. Select a predefined color gradient in the *Colormap* list or click the button to set the color gradient in the Color Gradient dialog.

When the selected color variable includes text data, the colors are specified by name or RGB value.

Colors can be specified in the worksheet by many different methods.

Method	**Example**
<color>	Red
<color>:<a>	Red:255
RGB(<r>,<g>,<b>)	RGB(255,0,0)
\COLOR(<r>,<g>,<b>,<a>)	\COLOR(255,0,0,255)
R<r> G<g> B<b>	R255 G0 B0
R<r> G<g> B<b> A<a>	R255 G0 B0 A255
\RGBR<r> \RGBG<g> \RGBB<b>	\RGBR255 \RGBG0 \RGBB0

where <r>, <g>, <b>, and <a> are red, green, blue, and alpha values between 0 - 255 and <color> is a color name as it appears in the color palette.

Show Color Scale

The *Show color scale* property is displayed when a *Color variable* is used for the symbol fill colors. Select the *Show color scale* property to display a color scale bar in the plot window. Clear the *Show color scale* property or delete the color scale to remove it from the plot window.

Line Properties

The *Line* controls the outside edge of the symbol. To change the symbol *Line* properties, click the next to *Line* to open the *Line* section. Set the *Style, Color, Opacity,* and *Width* for the edge of the symbol. Note that 3D plots do not support symbol outline colors. Refer to the Line Properties page for information about the various options.

Use Symbol Table

Check the box next to *Use symbol table* to determine the symbol based on a symbol table. The *Symbol table* option becomes active. Uncheck the box next to *Use symbol table* to turn off the symbol table functionality. The symbol table option allows symbols to change from one point to the next based on a table of symbols. A symbol table can also allow different symbols for each point or allow for repeating symbols.

Show Symbol Table Legend

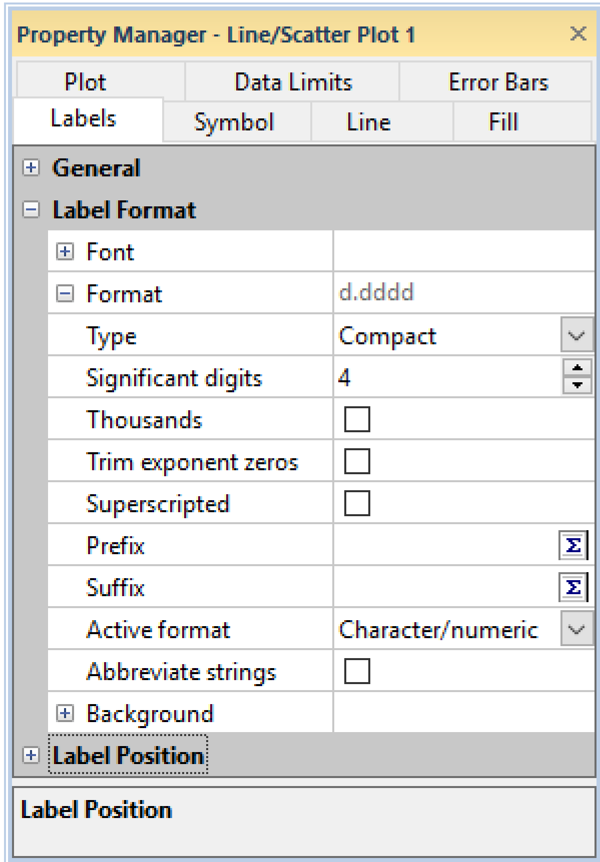
Select the *Show symbol table legend* property to display a symbol table legend.

Symbol Table

Click the *Set* button next to the *Symbol table* option to open the Symbol Table dialog and control which symbols are used in the plot.

Label Format

Labels contain text and other formatting such as the number of decimal places. You can change the label format in the *Format* section on the **Labels** tab in the **Property Manager**.



*Use the **Label Format** options to change the label format.*

Font

The *Font* section includes the font properties for the labels.

Sample

The sample shown next to the *Format* line shows the selected numeric format.

Type

There are five number format types available in the *Type:Compact, Fixed,Exponential, General*, and *Date/Time.*

The*Compact* option displays numbers as fixed or exponential depending on the number set in the *Significant digits* box. For example, if the numeric format is set to *General* with two significant digits, 1447 shows as 1.4E+03. If the *Significant digits* are set to six, 1447 is displayed as 1447.

The *Fixed* option displays numbers as dd.dd. Change theDecimal placesto show more or less fixed locations after the decimal character.

The *Exponential* option displays numbers as d.ddE+dd where

The *General* option displays the labels in fixed or exponential fashion, whichever requires fewer digits.

The *Date/Time* option displays the labels in a date time format. To use date/time formatted plot labels, the plot's data column must be formatted as date/time in the worksheet.

Significant Digits

The *Significant digits* display the total number of digits to use for the entire number. This option is only available when the *Type* is set to *Compact*.

Decimal Places

The numbers to the right of the decimal are set in the *Decimal places* box. For example, if the numeric format is set to *Fixed* with three decimal places, the number 2009 displays as 2009.000. This option is available when the *Type*is set to*Fixed*or*Exponential*.

Thousands

Check the *Thousands* box to show the *Thousands separator*to the left of every third digit left of the decimal symbol. The *Thousands* property is disabled when the *Type* is set to *Exponential*.

Thousands Separator

If the *Thousands* box is checked, a symbol will appear to the left of every third digit left of the decimal point. To set the symbol, click the existing option displayed next to *Thousands separator*. In the list, select *Auto, Period, Comma, Space,* or *Custom* to specify what will appear as the thousands separator. For example, if *Comma* is selected, then 8000 displays as 8,000. If *Period* is selected, then 8000 displays as 8.000. If *Space* is selected, then 8000 displays as 8 000. The button will be updated to reflect the selected separator symbol. The *Thousands Separator* property is disabled when the *Type* is set to *Exponential*.

Custom Separator

If *Thousands separator* is set to *Custom*, click in the box next to *Custom separator.* Enter a custom separator value into the box and press ENTER on the keyboard to make the change. The *Custom Separator* property is disabled when the *Type* is set to *Exponential*.

Trim Exponent Zeros

When *Compact* or *Exponential* is selected for the *Type,* the *Trim exponent zeros* option is available. When this box is checked, exponential numbers are written as 1.99E+2. When this box is not checked, exponential numbers are written as 1.99E+02.

Superscripted

When *Compact* or *Exponential* is selected for the *Type,* the *Superscripted* option is available. When this box is checked, exponential numbers are written as $1.99\text{x}10^2$. When this box is not checked, exponential numbers are written as 1.99E+02.

No 1x's

When the *Type* is set to *Compact* or *Exponential* and *Superscripted* is checked, you can remove the "1x" before the numbers by checking the box next to the *No 1x's* option. For example $1x10^2$ will be displayed as 10^2 when *No 1x's* is checked. This option will also make the value zero appear as 0.

Active Formats

- Select *Character/numeric* to display both text and numbers in the labels.
- Select *Character only* to show only text labels.
- Select *Numeric only* to show only numeric labels.

Abbreviate Strings

Check the *Abbreviate strings* box to limit the number of characters that appear in the label.

Max Characters

When the *Abbreviate strings* option is checked, the *Max characters* option is available. Set the number of characters that should appear in the labels in the *Max characters* box. Use the  buttons or enter a value directly into the box. Press ENTER on the keyboard to make the change.

Prefix

The *Prefix* property adds text in front of the labels. Type text or math text instructions in to the *Prefix* field or click the Σ button to open the Text Editor to add a label prefix. The *Prefix* font properties are controlled by the **Text Editor** or math text instructions and are not linked to the label font.

Suffix

The *Suffix* property adds text after the labels. Type text or math text instructions in to the *Suffix* field or click the Σ button to open the Text Editor to add a label suffix. The *Suffix* font properties are controlled by the **Text Editor** or math text instructions and are not linked to the label font.

Date/Time Format

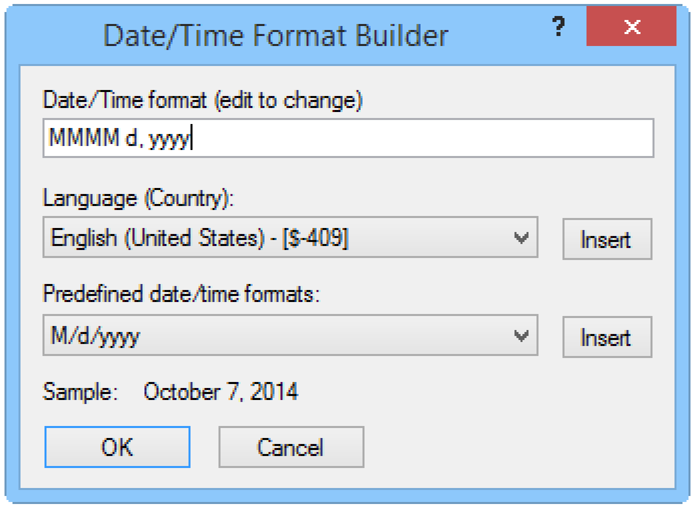
If you are using date/time formatting, click the *Select* button next to *Date/time format* to open the Date/Time Format Builder dialog. Custom date and time formats can be added, edited, or deleted in the **Date/Time Format Builder** dialog. Select the appropriate format and click *OK* to make the change and return to the *Format* section. Click *Cancel* to return to the *Format* section without making any change.

Background

The *Background* section includes the line properties and fill properties for the label background.

Date/Time Format Builder Dialog

In the Text Editor dialog, click the button to open the **Date/Time Format Builder** dialog. From the worksheet, click the ... button in the Format Cells dialog Number page. The **Date/Time Format Builder** dialog is also accessed by clicking the *Select* button in the *Date/time format* field in the Label Format section of the **Property Manager** and clicking a format in the Date/Time Labels dialog. When the **Date/Time Format Builder** is used to insert date/time math text instruction with the Text Editor, the date/time will update every time the project updates.



*The **Date/Time Format Builder** dialog is used to insert or create date/time formats for worksheet cells or text objects.*

Date/Time Format

Type a Date/Time Format into the *Date/Time format (edit to change)* field to set the date/time format. You can also use the *Language (Country)* and *Predefined date/time formats* lists to insert multiple date/time formats and languages.

Language (Country)

By default, the program will use the computer's default language settings for displaying the date/time options in the worksheet. The computer default is controlled by the Windows Control Panel. Refer to your Windows documentation for information about setting the locale. The *Language (Country)* uses the same codes to override the display. For instance, if the date/time values should always be displayed in English, regardless of locale, you could select *English (United States) - [$-409]* and click the *Insert* button. Insert the locale setting first in the *Date/Time format* box. Any cells with the specified language will appear in that language. In addition, the options in the *Predefined date/time formats* will change to show the common formats for that locale. Locale IDs are input as [$-####] in the *Date/Time format* field, where the #### is the locale identifier.

Note: The *Insert* button must be clicked after selecting the *Language (Country)* option. Simply selecting the *Language (Country)* does not change the *Date/Time format*. The *Date/Time format* does not change until *Insert* is clicked.

Predefined Date/Time Formats

The *Predefined date/time formats* list contains the common formats for the selected *Language (Country)* option or for your Windows locale. Available formats are made of combinations of year, month, day, hours, minutes, seconds, and AM/PM designation. Years are shown as yy or yyyy. Months are shown as M, MM, MMM, MMMM, or MMMMM. Days are shown as d, dd, ddd, or dddd. Hours are shown as h, hh, H, HH, or [h]. Minutes are shown as m, mm, or [mm]. Seconds are shown as ss, ss.0, ss.00, ss.000, ss.0000, or [ss]. AM/PM designation is shown as tt or TT. BC/AD designation is shown as gg or GG. BCE/CE designation is shown as g, G, ggg, or GGG. Refer to formats for information about each specific option.

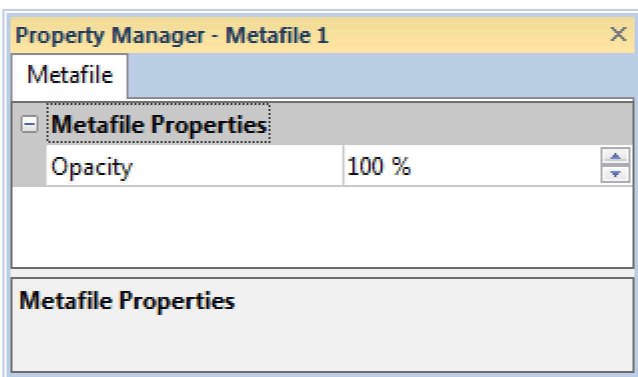
Note: The *Insert* button must be clicked after selecting the *Predefined date/time formats* option. Simply selecting the *Predefined date/time formats* does not change the *Date/Time format*. The *Date/Time format* does not change until *Insert* is clicked.

Sample

The *Sample* text updates to show a sample of the current entry in the *Date/Time format (edit to change)* field.

Metafile Properties

A selected metafile or enhanced metafile has a *Metafile Properties section* in the Property Manager. The actual contents of the metafile cannot be edited. If the contents of the metafile should be edited, opt to break apart the metafile when importing or pasting the metafile.



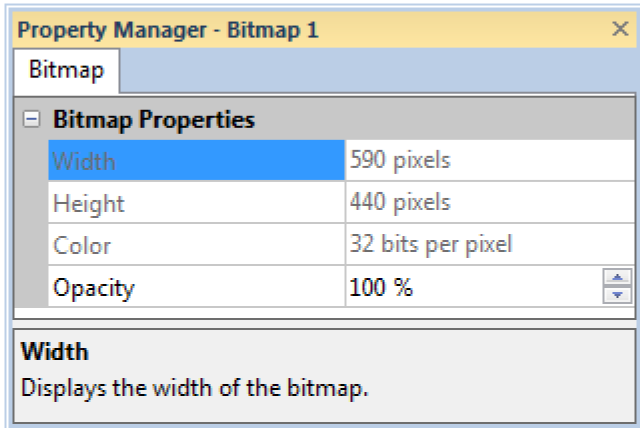
Set the opacity for the metafile in the Metafile Properties *section.*

Opacity

The *Opacity* value can be specified between 100% (full opacity, no transparency) to 0% (no opacity, full transparency).

Bitmap Properties

If you select a bitmap (image), the bitmap properties (*Width, Height, Color,* and *Opacity)* are displayed in the Property Manager.



View the Width, Height, *and* Color *depth for a bitmap.*
Set the opacity for the bitmap in the Bitmap Properties *section.*

Width, Height, Color

Width, *Height*, and *Color* are read-only properties. This is the size and color depth for the imported bitmap.

Opacity

The *Opacity* value can be specified between 100% (full opacity, no transparency) to 0% (no opacity, full transparency).

Altering the View

View Tab Commands - Plot Window

The **View** tab contains common commands to change the zoom, redraw, displaying managers, or arranging windows.

Some **View** tab commands are not available for the worksheet and grid documents.

Reset Windows	Resets the application display to the default layout
Object Manager	Check or clear to show or hide the **Object Manager**

Property Manager	Check or clear to show or hide the **Property Manager**
Worksheet Manager	Check or clear to show or hide the **Worksheet Manager**
Script Manager	Check or clear to show or hide the **Script Manager**
Hide All	Hides all managers in the program window
Show All	Shows all managers in the program window
Rulers	Turn on or off the display of the rulers
Grid	Turn on or off the display of the page grid
Status Bar	Shows or hides the status bar
Fit to Window	Scales the screen so that all objects are visible
Page	Shows the full page on screen
In	Zooms in
Out	Zooms out
Rectangle	Zooms with a rectangle
Selected	Zoom so the selected object fills the plot window
Full Screen	Turns off the display of ribbon and managers so the plot window fills the entire screen
Actual Size	Zooms so objects are approximately the actual size
Percent	Zooms to the desired percentage
Pan	Pans across the plot window
Redraw	Refreshes the image on screen
Auto Redraw	Turns the automatic redraw on and off
New Window	Opens a duplicate window of the active document
Cascade	Arranges the windows so they overlap
Arrange Icons	Arranges icons at the bottom of the application window
Tile Horizontal	Arranges windows horizontally so there are no overlapping tiles
Tile Vertical	Arranges windows vertically so there are no overlapping tiles
Switch Windows	Switch between open plot, worksheet, and grid document windows

Reset Windows

Click the **View | Display | Reset Windows** command to change the display of the program managers, keyboard shortcuts, and Quick Access Toolbar back to the default size, position, and settings. This command is especially handy if your managers become hidden by mistake.

You must restart **Grapher**in order for this command to take effect. Click*OK*in the dialog, close the program, and reopen**Grapher**. The default locations and settings are now used.

Display Managers

Check or uncheck the commands in the **View | Display** group to show or hide the Object Manager, Property Manager, Worksheet Manager, Script Manager, or Status Bar. A check mark is displayed next to visible managers.

Grapher managers can be docked to any side of the window or they can be displayed as floating windows.

- To dock the manager in a new location, click the manager name, hold the left mouse button, and then drag the manager to a new location.
- To dock a floating manager, double-click on the manager name.

.

Hide/Show All Managers

Click the **View | Display | Hide All** command to hide all manager windows and maximize the space available for viewing the plot window. This command is especially useful if you want to zoom in on the current graph and add or read text.

Use the **View | Display | Show All** command to change the view to include the plot window and all managers. Note: This command returns all managers to their respective locations before the **Hide All** command was used; it does not restore their default positions. Use the View | Display | Reset Windows command to restore the default window layout.

Fit to Window

When new graphs or other objects are added to the plot window or the existing graphs and objects are modified, it is possible that all objects are no longer fully visible in the plot window. Click the **Home | Zoom | Fit to Window** command, **View | Zoom | Fit to Window** command, right-click and select **Fit to Window**, or press CTRL+D on the keyboard to fit all existing objects into the window.

Click **Grid Tools | Zoom | Fit to Window** when viewing a grid document to scale the grid window so the entire grid is visible.

Page

Click the **View | Zoom | Page** command, right-click and select **View Page**, or press CTRL+G on the keyboard to view the entire page. The page outline is visible if the *Display page outline* option is checked in the File | Options dialog.

Zoom In

The **View | Zoom | In** command increases the magnification of the plot window. After clicking the command, click on the screen in the area where you want to zoom. The command increases the magnification of the image in the plot window. The command scrolls the window to keep the point of interest centered.

Zoom In - Grid Window

The **View | Zoom | In** command increases the magnification in the grid window. The window auto scrolls to keep the currently selected grid node near the center of the zoomed view.

Zoom In - Quick Access Toolbar

When the **View | Zoom | In** command is added to the Quick Access Toolbar, the command zooms in with the point of interest centered in the plot window or with the selected grid node centered in the grid window.

Zoom with a Wheel Mouse

You can use a wheel mouse to zoom in/out and pan in the plot window and grid window. Rotate the wheel forward to zoom in, or rotate the wheel backward to zoom out. Hold down the wheel button straight down, and the cursor will turn to a closed hand. When the cursor is a , drag the mouse to pan the plot window. Be sure to click straight down with the scroll wheel. The zoom is changed so that the cursor location remains on the screen.

Zoom with the Keyboard

You can use keyboard commands to zoom in and out of the plot window. The default commands are CTRL + = to zoom in, and CTRL + - to zoom out.

Zoom Out

The **View | Zoom | Out** command decreases the magnification of the plot window. After clicking the command, click on the screen in the area where you want to zoom. The command decreases the magnification of the image in the plot window. The command scrolls the window to keep the point of interest centered.

Zoom Out - Grid Window

The **View | Zoom | Out** command decreases the magnification in the grid window. The window auto scrolls to keep the currently selected grid node near the center of the zoomed out view.

Zoom Out - Quick Access Toolbar

When the **View | Zoom | Out** command is added to the Quick Access Toolbar, the command zooms out with the point of interest centered in the plot window or with the selected grid node centered in the grid window.

Zoom with a Wheel Mouse

You can use a wheel mouse to zoom in/out and pan in the plot window and grid window. Rotate the wheel forward to zoom in, or rotate the wheel backward to zoom out. Hold down the wheel button straight down, and the cursor will turn to a closed hand. When the cursor is a  , drag the mouse to pan the plot window. Be sure to click straight down with the scroll wheel. The zoom is changed so that the cursor location remains on the screen.

Zoom with the Keyboard

You can use keyboard commands to zoom in and out of the plot window. The default commands are CTRL + = to zoom in, and CTRL + - to zoom out.

Zoom Rectangle

Click the **View | Zoom | Rectangle** command or press CTRL+R on the keyboard to increase the magnification by drawing a rectangle around the area of interest. After clicking the command, click and hold down the left mouse button and drag a rectangle around the area of interest. The plot window is magnified to show only this area.

Selected

Click the **View |Zoom | Selected** command, right-click on a selected object and click **Zoom Selected**, or press CTRL+L on the keyboard to magnify the display to show the selected objects at the maximum size possible in the window.

Full Screen

Click the **View | Zoom | Full Screen** command or press F11 on the keyboard to scale the image to fit the monitor. The ribbon commands and managers are not accessible when viewing **Full Screen**. Press the ESC key or click on the screen with the mouse to return to the **Grapher** window.

Actual Size

Click the **View | Zoom | Actual Size** command to scale the drawing to the approximate size it will be when printed. The size is usually scaled up slightly on the display to allow an adequate size for displaying text.

Zoom Percent

Type a value in the **View | Zoom | Percent** command field 

to zoom to a specific amount of magnification in the plot window. Setting the percentage to 100 percent is the same as using the View | Zoom | Actual Size command. To change the zoom level, highlight the existing value and type the desired value. Press ENTER on the keyboard to make the change.

Pan

The plot window can be panned. This is useful when the scene is magnified and you would like to look at a different portion of the object. To use this feature, click the **View | Pan** command. Click and hold the left mouse button and drag the cursor around the window to pan. Exit pan mode by pressing ESC, clicking **View | Pan** again, clicking the zoom **In**, **Out**, or **Rectangle** command, or clicking a Draw command.

Pan with a Wheel Mouse

You can use a wheel mouse to zoom in or zoom out and pan in the plot window and grid window. Rotate the wheel forward to zoom in, or rotate the wheel backward to zoom out. Hold down the wheel button straight down, and the cursor will turn to a closed hand. When the cursor is a , drag the mouse to pan the plot window. Be sure to click straight down with the scroll wheel. The zoom is changed so that the cursor location remains on the screen.

Redraw

Click the **View |Redraw | Redraw** command or press F5 on the keyboard to redraw the window. This is useful if the View | Redraw | Auto Redraw option is unchecked.

Auto Redraw

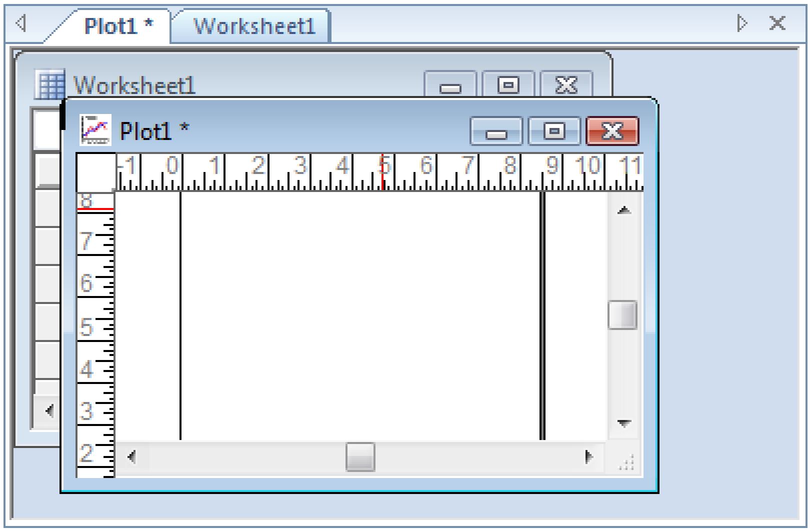
Check the **View | Redraw | Auto Redraw** command to automatically redraw the plot window each time the window contents are changed. The **Auto Redraw** option is on by default, and this is indicated by a check mark next to the command. Select the **View | Redraw | Auto Redraw** command to toggle the command on and off. If **Auto Redraw** is unchecked, use the View | Redraw | Redraw command or press the F5 key on the keyboard to redraw the image.

New Window

Click the **View | Window | New Window** command to create a duplicate window. You can display different views or different parts of the same document simultaneously by using **New Window**. Objects can be edited in either window and the changes appear in both windows.

Cascade

The **View | Window | Cascade** command is used to arrange multiple document windows in an overlapped fashion. Each window is offset a small amount from the previous window. Individual windows can be sized by dragging the window borders.



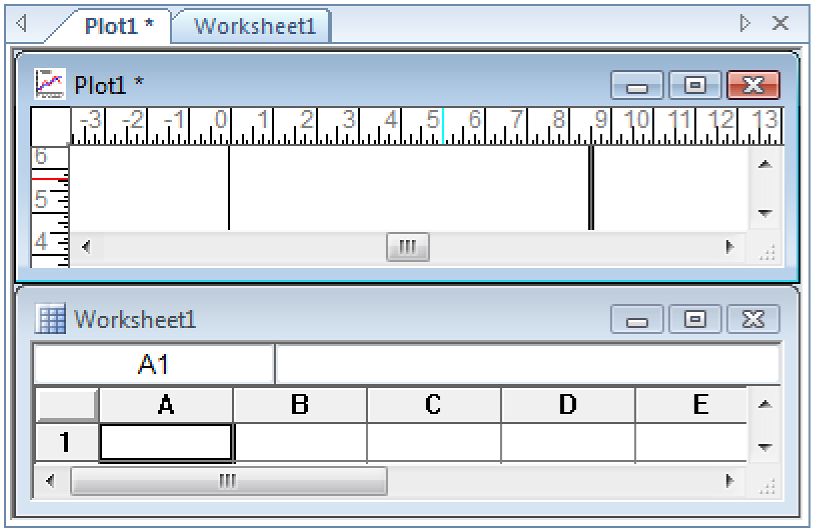
*The worksheet and plot windows are shown after the **Cascade** command was used.*

Arrange Icons

Click the **View | Window | Arrange Icons** command to arrange the icons for minimized windows at the bottom of the main window. If a maximized window exists, then some or all of the icons may be located underneath the window.

Tile Horizontal

Click the **View | Window | Tile Horizontal** command to arrange multiple document windows in a non-overlapped fashion such that the windows are oriented one above the other.

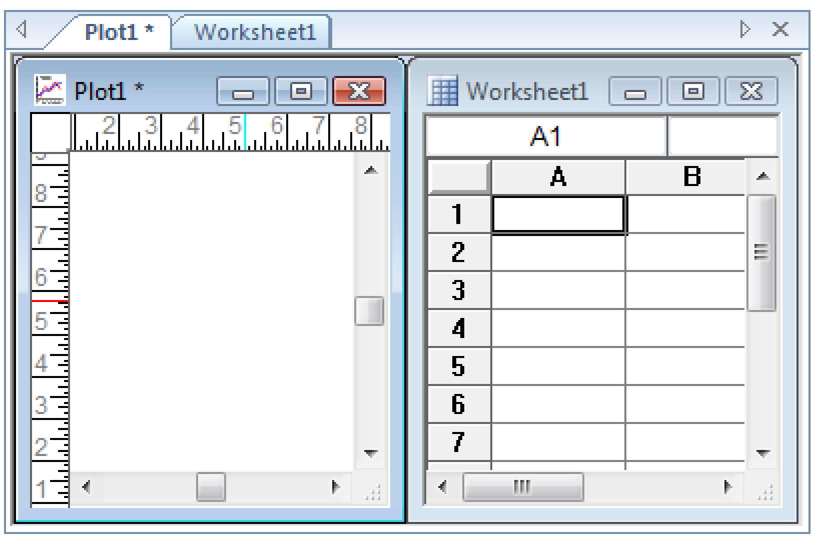


The worksheet and plot windows are shown after the ***Tile Horizontal*** *command was used.*

Tile Vertical

Click the **View | Window | Tile Vertical** command 

to arrange multiple windows in a non-overlapped fashion side by side.



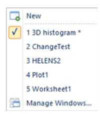
The worksheet and plot windows are shown after the ***Tile Vertical*** *command was used.*

Switch Windows

The **View | Window | Switch Windows** command makes an open plot, worksheet, or grid document the active window, similar to the document tabs. The **Switch Windows** command can also be used to open a new window or manage the currently open windows.

Switch Windows List

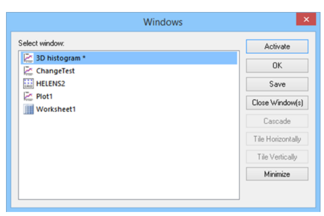
A context menu is opened when the **View | Window | Switch Windows** command is clicked. The active window is indicated with a check mark. Click a window name in the list to make the window the active window. Click the **New** command to open a duplicate of the current active window as with the New Window command. Click the **Manage Windows** command to manage all the open document windows in the **Windows** dialog.



*The **Switch Windows** list contains the **New** command, all open documents, and the **Manage Windows** command.*

Windows Dialog

The **Windows** dialog is opened when the **View | Window | Switch Windows | Manage Windows** command is clicked. The **Windows** dialog contains many of the same commands as the **View | Window** section of the ribbon. The commands can be used on all or some of the open windows.



*The **Windows** dialog contains command for managing open windows.*

Selecting Windows

One or more windows can be selected in the *Select window* list. Click a window name to select the window. Hold CTRL while clicking to select multiple windows. Click a window name, hold the SHIFT key, and click another window name to select a contiguous list of windows. The window document type is indicated by the icon before the window name. Documents with unsaved changes are indicated by an asterisk (*).

Activate a Window

Click *Activate* to activate the selected window. Only one window may be selected to use *Activate*. The *Activate* button is disabled when more than one window is selected in the *Select Windows* list. The **Windows** dialog is closed after *Activate* is clicked.

Saving Document Changes

Click *Save* to save the changes in the selected windows. Clicking *Save* is similar to using the Save command for each selected document. If a document has not been previously saved, then the Save As dialog is opened for the document. The *File name* in the **Save As** dialog will be the window name until it is changed by the user.

Closing Windows

Click *Close Window(s)* to close the selected window or windows. You will be prompted to save the document before it closes If the document has unsaved changes.

Cascade

Click *Cascade* to cascade the selected windows. Two or more windows must be selected to use *Cascade*. Windows that are not selected will be minimized along bottom of the plot window.

Tile Horizontally

Click *Tile Horizontally* to tile the selected windows horizontally. This works the same as the Tile Horizontal command, but only on the selected windows. Two or more windows must be selected to use *Tile Horizontally*.

Tile Vertically

Click *Tile Vertically* to tile the selected windows vertically. This works the same as the Tile Vertical command, but only on the selected windows. Two or more windows must be selected to use *Tile Vertically*.

Minimize

Click *Minimize* to minimize the selected window or windows.

Closing the Windows Dialog

Click *OK* or to close the **Windows** dialog.

Editing

Cut

Click the **Home | Clipboard |Cut** command or press CTRL+X on the keyboard to move the selected items to the clipboard. This deletes the selected objects from the file after copying the objects to the clipboard. Cut objects can later be pasted with the Paste or Paste Special commands.

Only one plot window selection or one worksheet selection may be placed in the clipboard at a time. The next **Cut** or Copy command replaces the contents of the clipboard.

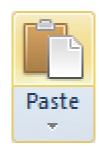
Copy

Use the **Home | Clipboard | Copy** command or press CTRL+C on the keyboard to move the selected items to the clipboard. The original objects remain in the window. Use this command to duplicate objects in a different location in the same window, or to copy the objects into a different window or application. The copied objects can later be pasted with the Paste or Paste Special commands.

Only one plot window selection or one worksheet selection may be placed in the clipboard at a time. The next Cut or **Copy** command replaces the contents of the clipboard.

Paste

Click the **Home | Clipboard | Paste** command or press CTRL+V on the keyboard to paste the clipboard contents into the current document. The objects to be copied must first be placed in the clipboard using the Home | Clipboard | Cut or Home | Clipboard | Copy commands of **Grapher** or some other application. The clipboard contents remain on the clipboard until something new is cut or copied to the clipboard.



*Click the **Paste** button to paste the object to the window.*

Click the down arrow on the **Paste** command to select the Paste Special or Paste Format command.

Plot Window

In the plot window, the pasted object is positioned in the center of the current plot extents.

Worksheet

In the worksheet, the upper left corner of the pasted data is placed in the active cell. Any cells in the existing worksheet that lie to the right of and below the active cell will be overwritten with the contents of the pasted data. The following rules are used to paste into the worksheet:

- Only the TAB character is recognized as a column separator. Spaces, commas, semi-colons, etc. are included in a text cell.
- The RETURN character is recognized as the row separator.
- Numbers paste as number values. The period can always be used as a decimal separator, and the system locale determines any other decimal separator. For example if the system locale uses a comma as the decimal separator, then both 123.456 and 123,456 are pasted as the number 123,456.
- Mixed text and numbers paste as text.
- Dates and/or times will paste as date values in a wide variety of date/time formats. Ambiguous dates are determined by the system locale setting. If dates are not pasted correctly, consider using Paste Special and the *Locale* settings in the Data Import Options dialog.

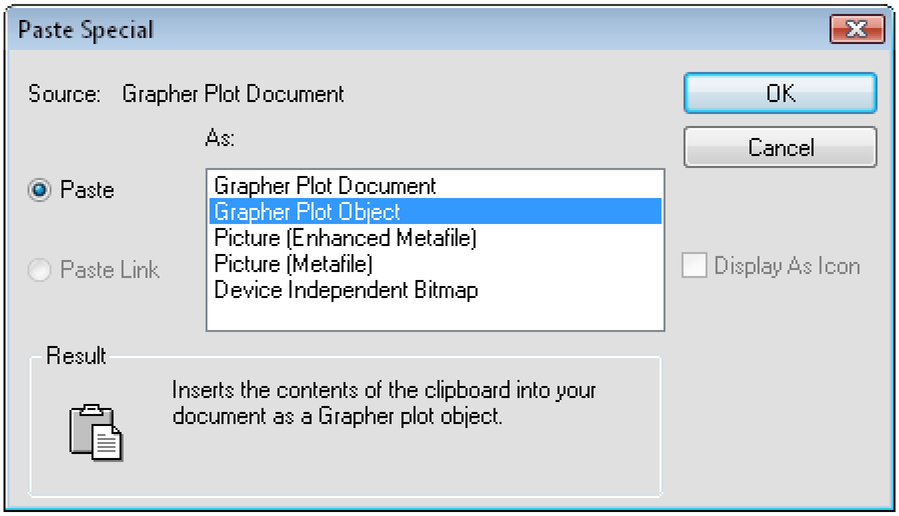
Pasting a Single Cell's Contents Across Multiple Cells

A single cell's contents can be pasted into multiple cells by coping the cell, selecting a block of cells, and using the **Paste** command. Each cell in the selection is populated with the clipboard contents when this operation is performed. If more than one cell is copied then the copied cells are only pasted once.

The multiple paste operation will not be performed for an entire row, entire column, or across multiple selections. When an entire row or column is selected, only the first cell in the row or column will receive the pasted content. If you attempt to paste in multiple selections an error message will be displayed.

Paste Special

Clicking the **Home | Clipboard | Paste | Paste Special** command opens the **Paste Special** dialog, where you have the option of specifying the format to use when pasting the object into **Grapher**. Use the **Home | Clipboard | Paste | Paste Special** command for selecting one of several formats for pasting the clipboard contents. See the *Paste Special - Worksheet* topic for selecting the format when pasting into the worksheet.



*Use the **Paste Special** dialog in the plot window to paste objects from the clipboard.*

Source

Source indicates the program used to create the clipboard contents. For example, if a **Grapher**object is copied to the clipboard, *Grapher Plot Document* appears in the source field. The source can be **Grapher**, *Unknown*, or other software applications. You cannot insert a **Grapher**Plot Document into an existing**Grapher**document.

Paste Type

You can insert an object into the document by pasting or by pasting a link to the object.

Selecting *Paste* embeds an OLE object into the document. Changes you make to the embedded information will not be reflected in the original document, and changes to the original document will not appear in this document.

Selecting *Paste Link* links the object to another software application. Non-OLE objects are pasted as they appeared in the original document and they cannot be edited. Changes you make to the linked information in this file will be reflected in the original file, and changes in the original file will also appear in this file.

When pasting a linked object, the link remains available as long as the information is contained on the clipboard. The link changes to "unknown" if the server application is closed or if new information is copied to the clipboard.

Formats

Paste special format types vary depending on the origin of the clipboard information. The *As* field lists the available formats. Use the *As*field to specify how the information is pasted into your document. You can highlight the clipboard format in the *As* box and then refer to the *Result* box for more information on clipboard format types. This option is not available for some types of documents.

Display as Icon

Display As Icon is available for OLE objects. *Display As Icon* specifies whether the information or an icon representing the information will appear in the file. If *Display As Icon* is checked, an icon appears in the document rather than the complete object. Change the icon and title by clicking the *Change Icon* button. If the box is not checked, the complete object appears in the document. After the icon is displayed in the graph, double-click the icon to show the complete object.

Result

The *Result* section specifies how the contents of the clipboard will be formatted when pasted into the document, based on the selection you made.

OK or Cancel

To insert the information into your current document, click *OK.*To exit the dialog without inserting the information into your current document, click*Cancel*.

Copy Format

Click the **Home | Clipboard | Copy Format** command or press CTRL+SHIFT+C on the keyboard to copy the selected object's properties. The original object remains in the plot window. The properties of the selected object, such as line, fill, symbol, text format, are copied. Select another object and click the Home | Clipboard | Paste | Paste Formatcommand to paste the copied properties to the newly selected object.

To copy and paste properties:

1. Click on an object in the plot window or **Object Manager**.
2. Click the **Home | Clipboard | Copy Format** command. The object properties are copied to the clipboard.
3. Click on another object, or multiple objects, to select.
4. Click the**Home | Clipboard | Paste | Paste Format**command.

The currently selected objects update to show the same properties as the original object.

Some options, such as axis limits, do not support the copy and paste format.

Paste Format

Click the **Home | Clipboard | Paste | Paste Format** command or press CTRL+SHIFT+V on the keyboard to paste the clipboard format's properties to a newly selected object. The original object remains in the plot window. The properties of the original object, such as line, fill, symbol, text format, are copied. After the **Paste**command is pressed, the copied properties are applied to the newly selected objects.

To copy and paste properties:

1. Click on an object in the plot window or **Object Manager**.
2. Click the Home | Clipboard | Copy Format command. The object properties are copied to the clipboard.
3. Click on another object, or multiple objects, to select.
4. Click the **Home | Clipboard | Paste | Paste Format** command. The currently selected objects update to show the same properties as the original object.

Some options, such as axis limits, do not support the copy and paste format.

Undo

Click the **Home | Undo |Undo** command, click the  button on the Quick Access Toolbar, or press CTRL+Z on the keyboard to reverse the last operation performed. If the last operation cannot be reversed, the **Undo** command is disabled.

After you have undone an operation, the Home | Undo | Redo command becomes highlighted, allowing you to reverse the just completed **Undo** command. Up to 200 undo levels can be set in the General section in the Options dialog.

Redo

Click the **Home | Undo | Redo** command, click the  button on the Quick Access Toolbar, or press CTRL+Y on the keyboard to reverse the last Undo command.

Delete

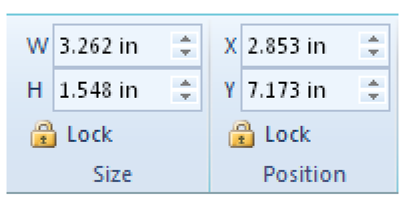
Click the **Home | Selection | Delete** command or press the DELETE key on the keyboard to remove a selected object from the document. An object can sometimes be restored by clicking the Home | Undo | Undo command.

If the object is part of a higher level object and is currently in use by the object, then it cannot be deleted. For example, if a line/scatter plot is using *Y Axis 1*and you select *Y Axis 1* and attempt to delete it, the **Home | Selection | Delete** command is disabled and the deletion is not allowed. If the line/scatter plot were using a different axis, then you would be allowed to delete *Y Axis 1*.

Objects in a *Group* object cannot be deleted unless you enter the group. To delete individual items in a *Group* object, click on the *Group* object and click the Insert | Group | Edit Group command or right-click on the *Group* and select **Edit Group**. Select the item to delete and click the **Home | Selection | Delete** command. To exit the group, click the Insert | Group | Stop Editing Group command or right-click on the *Group* and select **Stop Editing Group**.

Resize Objects

You can resize objects graphically with the mouse or keyboard, and with the **Size** group on the **Layout** tab.



*Change the size or position of any object in the **Size** or **Position** group on the **Arrange** tab.*

Selected objects appear with selection handles at the corners and sides of the bounding box for the object. The size of a selected object is displayed in the status bar and in the Size group. The pointer changes to a two-headed arrow when it is moved over one of the selection handles. You can resize a single selected object or several selected objects using the following methods.

- To drag a handle with the mouse, move the pointer over the handle and then press and hold the left mouse button. Move the pointer to a new position. Release the left mouse button and the object is resized.
- To drag a handle with the keyboard, move the pointer over the handle, press and hold the SPACEBAR, and use the ARROW keys to move the pointer to a new position. Release the SPACEBAR and the object is resized.
- Drag one of the four corner handles to size the object proportionally.
- Drag one of the side handles to stretch or compress the object in one dimension only.
- Press and hold the ALT key while dragging a corner handle with the mouse to free size an object.
- Press and hold the CTRL key while dragging a corner handle with the mouse to square resize an object.
- Set the size of axes in the axis properties dialog.
- You can use the *W* and *H* fields in the Size group to change the size of an object.

Some objects, such as rotated graphs, cannot be resized. Also, some objects such as axes can only be resized in one direction.

Arrange

Layout Tab Commands

The **Layout** tab contains commands for modifying the layout of the page in the plot document and the arrangement of objects in the plot document.

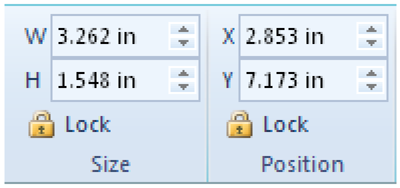
None of the **Layout** tab commands are available for the worksheet and grid documents.

Margins	Set the page margins to **Normal**, **Narrow**, **Moderate**, or **Wide** or open the Page Setup dialog to set custom margins
Orientation	Set the page orientation to **Portrait** or **Landscape**
Size	Set the paper size to **Letter**, **Legal**, **Ledger**, **A4**, or **Envelope**, or open the Page Setup dialog to set the page to any available size for the selected printer

Printer	Open the Page Setup dialog to select the printer to use
Fill	Set the page background fill properties
Header	Set the header text for the page and set the header alignment on the page to **Left**, **Center**, or **Right**
Footer	Set the footer text for the page and set the footer alignment on the page to **Left**, **Center**, or **Right**
Page Outline	Turn on or off the display of the page outline
Margins	Turn on or off the display of the margins
Units	Set the page units to either inches or centimeters
X and **Y**	Set the object's position
Lock Position	Locks an object's position
W and **H**	Set the size of a selected object
Lock Size	Locks the size of a selected object
Move	Arranges objects draw order with move to front, move to back, move forward, or move backward
Align	Aligns objects horizontally to the left, center, or right of the selection or vertically to the top, middle, or bottom of the selection
Horizontally	Horizontally aligns objects with equal spacing within their bounding box
Vertically	Vertically aligns objects with equal spacing within their bounding box
Custom Angle	Rotates an object by specified degrees
Free Rotate	Rotates an object with the mouse
Reset Rotation	Set the selected graph's rotation to zero

Positioning and Sizing Objects

The **Position** and **Size** groups on the Layouttab contain options to position and size objects. Objects can also be positioned and resized using the mouse and keyboard. Objects can also be repositioned by dragging them to a new location with the mouse or with the keyboard.



*Change the size or position of any object in the **Size** or **Position** group on the **Layout** tab.*

Width and Height

Use the width (*W*) and height (*H*) controls to set the width and height of the selected object. Some objects do not have a width or height. For example, Y axes do not have a width, so setting the width has no effect. To change the size, highlight the existing value and type the desired value. Or, click the buttons to increase or decrease the size. Press ENTER on the keyboard to make the change.

Horizontal and Vertical Position

Use the horizontal position (*X*) and the vertical position (*Y*) to set the X, Y position on the page for most objects. To change the location, highlight the existing value and type the desired value. Or, click the buttons to increase or decrease the position. Press ENTER on the keyboard to make the change.

The X, Y location of the cursor is displayed in the status bar. This can be a good source of reference.

Lock Position

To lock an object's position, click on the object to select it and click the **Layout | Position | Lock** command. You may also right-click on the object and select **Lock Position**. When an object is locked it cannot be moved either through the ribbon*X* and *Y* boxes, by dragging it with the mouse, or by changing object properties in the **Property Manager**. Objects that are position locked can be resized.

Repeat the above instructions to unlock a locked object.

When an object's position is locked, the object's visibility check box in the **Object Manager** appears with a lock in the bottom-left corner . When an object's position and size are locked, the box appears with locks in both lower corners .

Lock Size

To lock an object’s size, click on the object to select it and click the **Layout | Size | Lock** command. When an object is locked it cannot be resized either through the ribbon*W* and *H* boxes, by dragging it with the mouse, or by changing object properties in the **Property Manager**. Objects that are size locked can be moved on the page.

Repeat the above instructions to unlock a locked object.

When an object's size is locked, the object's visibility check box in the **Object Manager** appears with a lock in the bottom-right corner . When an object's position and size are locked, the box appears with locks in both lower corners .

Align

Objects can be aligned vertically or horizontally. To align objects horizontally, select two or more objects. Click a **Layout |Align** command to align selected objects relative to the bounding box surrounding the selected objects. The horizontal alignment commands include **Left**, **Right**, and **Center**.

The **Left** command aligns all selected objects along the left side of the bounding box.

The **Right** command aligns all selected objects along the right side of the bounding box.

The**Center**commandcenters all selected objects between the left and right sides of the bounding box.

To align objects vertically, select two or more objects. Click a **Layout|Align** command to align selected objects relative to the bounding box surrounding the selected objects. The vertical alignment commands include **Top**, **Middle**, and **Bottom**.

The **Top** commandaligns all selected objects along the top of the bounding box.

The**Bottom** command aligns all selected objects at the bottom of the bounding box.

The**Middle** command aligns all selected objects between the top and bottom sides of the bounding box.

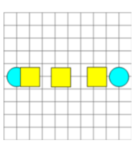
Distribute Horizontally

Click the **Layout | Distribute | Horizontally** command to distribute three or more objects from left to right with equal spacing. The interior object or objects are aligned horizontally between the outermost objects. This means the bounding box size does not change, and the left and right objects do not move, while the objects are arranged. Three or more objects must be selected to enable the **Distribute | Horizontally** command. If the objects must overlap to fit inside the bounding box, the objects are distributed with equal overlap.

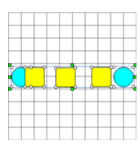
The following steps demonstrate how to distribute objects horizontally:

1. Move the outside objects to the desired locations.
2. Select the objects that are to be distributed, including the furthest left and furthest right objects.
3. Click the **Layout | Distribute | Horizontally** command.

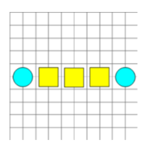
The interior objects are arranged between the outer most objects with equal spacing.



*Five objects are unevenly spaced. The circles are moved to the desired locations. The **Layout | Align | Middle** command was used to align the objects in a row.*



*All five objects are selected before the **Horizontally** command is used.*



*The **Arrange | Distribute | Horizontally** command is clicked and the objects are now equally spaced from left to right.*

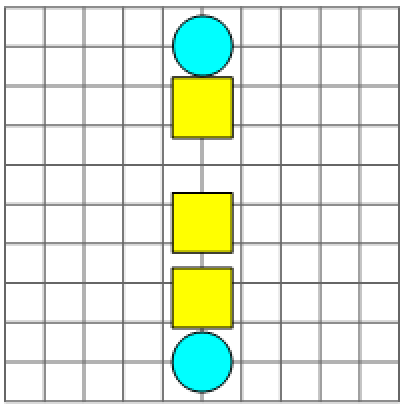
Distribute Vertically

Click the **Layout | Distribute | Vertically** command to distribute three or more objects from top to bottom with equal spacing. The interior object or objects are aligned vertically between the outermost objects. This means the bounding box size does not change, and the top and bottom objects do not move, while the objects are arranged. Three or more objects must be selected to enable the **Distribute | Vertically** command. If the objects must overlap to fit inside the bounding box, the objects are distributed with equal overlap.

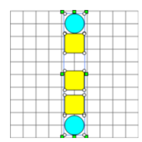
The following steps demonstrate how to distribute objects vertically:

1. Move the outside objects to the desired locations.
2. Select the objects that are to be distributed, including the top and bottom objects.
3. Click the **Layout | Distribute | Vertically** command.

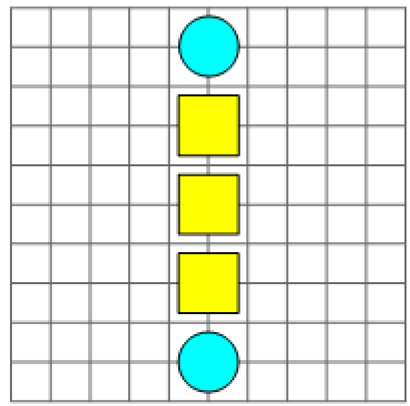
The interior objects are arranged between the outer most objects with equal spacing.



*Five objects are unevenly spaced. The circles are moved to the desired locations. The **Layout | Align | Center** command was used to align the objects in a column.*



*All five objects are selected before the **Vertically** command is used.*



*The **Arrange | Distribute | Vertically** command is clicked and the objects are now equally spaced from top to bottom.*

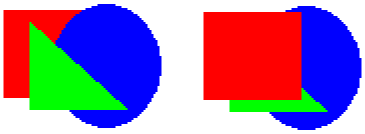
Move

Click the **Layout |Move** commands to move the position of objects in the **Object Manager**. Objects can also be moved by dragging them to a new position in the Object Manager.

The **Move** commands include **To Front**, **To Back**, **Forward**, and **Backward**.

To Front

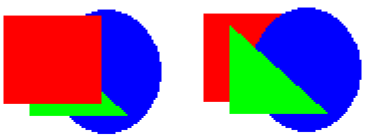
The **To Front** command moves the selected object to the front. The object will appear on top of the other objects.



In the left drawing, the red square is located behind all of the other objects. Use **Move to Front** to move the square to the front layer so that it appears in front of all the other objects (right drawing).

To Back

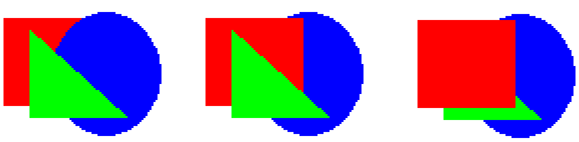
The **To Back** command moves the selected objects to the back. The object will appear behind the other objects.



In the left drawing, the red square is located in front of all the other objects. Use **Move to Back** to move the square to the back layer so that it appears behind all of the other objects (right drawing).

Forward

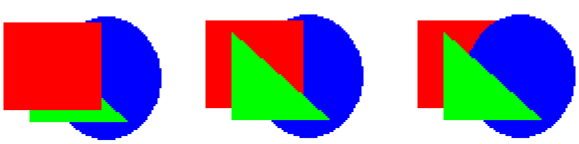
The **Forward** command moves the selected objects forward one layer.



In the left drawing, the red square is located behind all the other objects. Use **Move Forward** to move the square forward one layer so that it appears between the circle and the triangle (middle drawing). Selecting **Move Forward** again places the square on top of the other objects (right drawing). **Move to Front** also places the square on top of the other objects.

Backward

The **Backward** command moves the selected object backward one layer.



In the left drawing, the red square is located in front of all the other objects. Use **Move Backward** to move the square back one layer so that it again places the square behind all of the other objects (right drawing). **Move to BackMove to Back** also places the square behind the other objects.

Group

The **Insert | Group | Group** command is used to group several independent objects into one combined group object. Select two or more objects and click the **Insert | Group | Group** command or right-click on the objects and select **Group**to create one combined group object. Group objects can be a combination of graphs and drawing objects. The objects in the group can be resized and edited individually. The group is moved as a single object, with all objects in the group moving together.

Editing Individual Items in a Group

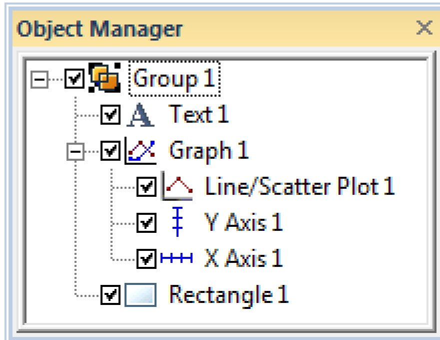
After objects are grouped together, the group is displayed in the Object Manager as a *Group* object with sub-objects. Individual properties of the sub-objects can be edited by clicking on the sub-object in the **Object Manager**. Properties for that object are displayed in the Property Manager.

Sub-objects can be re-arranged in the **Object Manager**. Click and drag a sub-object in the **Object Manager** to rearrange to the order objects are drawn in the *Group*.

To delete a sub-object, click the Insert | Group | Edit Group command. Click on the sub-object and press the DELETE key on the keyboard to delete it. Click the Insert | Group | Stop Editing Group command to return to normal editing mode.

Moving Objects in a Group

To move the location of individual objects with respect to others in the group, click the Insert | Group | Edit Group command. Click on the individual object and move it to the new desired location. Once you have completed moving the objects, click the Insert | Group | Stop Editing Group command to exit the group.



The Group 1 *object is the group object. Click on the* Group 1 *object to move the entire group. Click on the objects below the* Group 1 *object to select and edit individual objects.*

Ungroup

Click the **Insert | Group |Ungroup** command or right-click on a *Group* object and select **Ungroup** to separate objects that have been previously combined into a *Group* object using the Insert | Group | Group command.

Editing Individual Items in a Group

After objects are grouped together, the group is displayed in the Object Manager as a *Group* object with sub-objects. Individual properties of the sub-objects can be edited by clicking on the sub-object in the **Object Manager**. Properties for that object are displayed in the Property Manager.

Sub-objects can be re-arranged in the **Object Manager**. Click and drag a sub-object in the **Object Manager** to rearrange to the order objects are drawn in the *Group*.

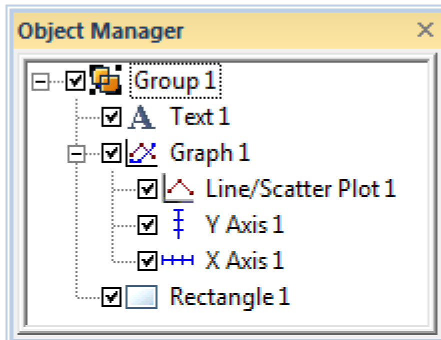
To delete a sub-object, click the Insert | Group | Edit Group command. Click on the sub-object and press the DELETE key on the keyboard to delete it. Click the Insert | Group | Stop Editing Group command to return to normal editing mode.

Moving Objects in a Group

To move the location of individual objects with respect to others in the group, click the Insert | Group | Edit Group command. Click on the individual object and move it to the new desired location. Once you have completed moving the objects, click the Insert | Group | Stop Editing Group command to exit the group.

Ungrouping Imported Objects

The **Insert | Group | Ungroup** command can also be used on imported files including Golden Software Boundary .GSB, Atlas Boundary .BNA, USGS .DLG, .LGO, .LGS, AutoCAD .DXF, Golden Software Blanking .BLN, Metafiles, as well as on pasted objects.



The Group 1 *object is the group object. Click on the* Group 1 *object to move the entire group. Click on the objects below the* Group 1 *object to select and edit individual objects.*

Edit Group

Click the **Insert | Group | Edit Group** command or right-click on a *Group* object and select **Edit Group** to edit the objects in a group. Once in the edit group mode, new objects can be added or existing objects can be moved relative to other grouped objects.

Open Group

An open group is indicated when the bounding box changes from all objects in the *Group* being selected with a single large bounding box to only one object being selected. When the group is open, the editing and drawing commands operate within the group only. New objects can be added to the group. Multiple objects can be selected, deleted, moved, or edited. Objects outside the group cannot be edited.

Stop Editing Group

Click the **Insert | Group | Stop Editing Group** command or right-click on the *Group* object and select **Stop Editing Group** to end the edit group mode. The **Stop Editing Group** command must be selected to select and edit objects outside the group.

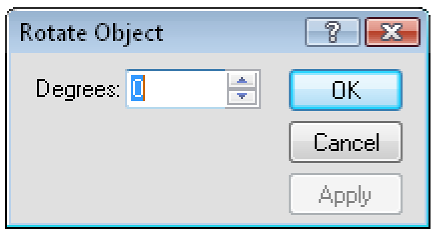
Stop Editing Group

Click the **Insert | Group | Stop Editing Group** command or right-click on an open *Group* object and select **Stop Editing Group**to end the edit group mode.

The **Insert | Group | Stop Editing Group** command must be clicked before you can select and edit objects outside the group.

Custom Angle

Click the **Layout | Rotate | Custom Angle** command to rotate an object by a specified number of degrees. After selecting the command, type the number of degrees to rotate the object into the **Rotate Object** dialog. Some objects cannot be rotated.



*Use the**Rotate Object**dialog to rotate an object by a specified number of degrees.*

Rotation Direction

Positive numbers rotate the object in a counterclockwise direction. Negative numbers rotate the object in a clockwise direction.

Rotation Tip

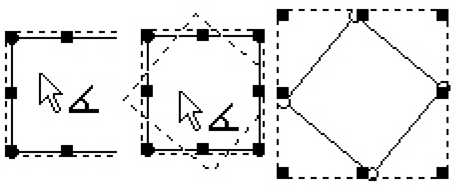
To set the rotation of a 3D graph, use the 3D Settings tab in the **Property Manager** or the Layout | Rotate | Free Rotate command.

Free Rotate

Click the **Layout | Rotate | Free Rotate** command or right-click on an object or group of objects and select *Free Rotate* to rotate a selected object with the mouse. After selecting the command, the cursor will change to or to indicate that the program is in rotate mode. Some objects cannot be rotated.

To rotate an object or a 2D graph:

1. Click on an object to select it.
2. Click the **Layout | Rotate | Free Rotate** command or right-click and select **Free Rotate**. The cursor changes to  .
3. Click inside the object’s bounding box and hold the left mouse button while moving the pointer.
4. As the object is rotated, the degrees of rotation are indicated in the status bar and a dotted line showing the rotated location is displayed in the plot window.
5. Release the mouse button to rotate the object to the new degree of rotation.



Click and drag the object to the new desired rotation.

To rotate a 3D graph:

1. Click on any part of the 3D graph to select it. The axes, plot, fill, etc. can be selected.
2. Click the **Layout | Rotate | Free Rotate** command or right-click and select **Free Rotate**. The cursor changes to .
3. Click inside the object’s bounding box and hold the left mouse button while moving the pointer.
4. Left-click, hold the mouse button down, and drag the mouse to rotate the graph. A blue bounding box will display the graph outline as it is rotated.
5. Release the mouse button and the graph updates to the desired rotation.
6. Press ESC on the keyboard to end rotate mode.

Alternatively, use 3D Settings in the **Property Manager** to rotate a 3D graph.

To restore a 3D graph to the original rotation, click anywhere on the graph and click the Layout | Rotate | Reset Rotation command.

Reset Rotation

Click the **Layout | Rotate | Reset Rotation** command to reset a rotated 2D or 3D graph to the default orientation. The command is only available when a rotated graph is selected in the plot window. The rotation can also be reset by clicking on the graph and clicking the *Reset position* command in the **Property Manager** on the 3D Settings tab.

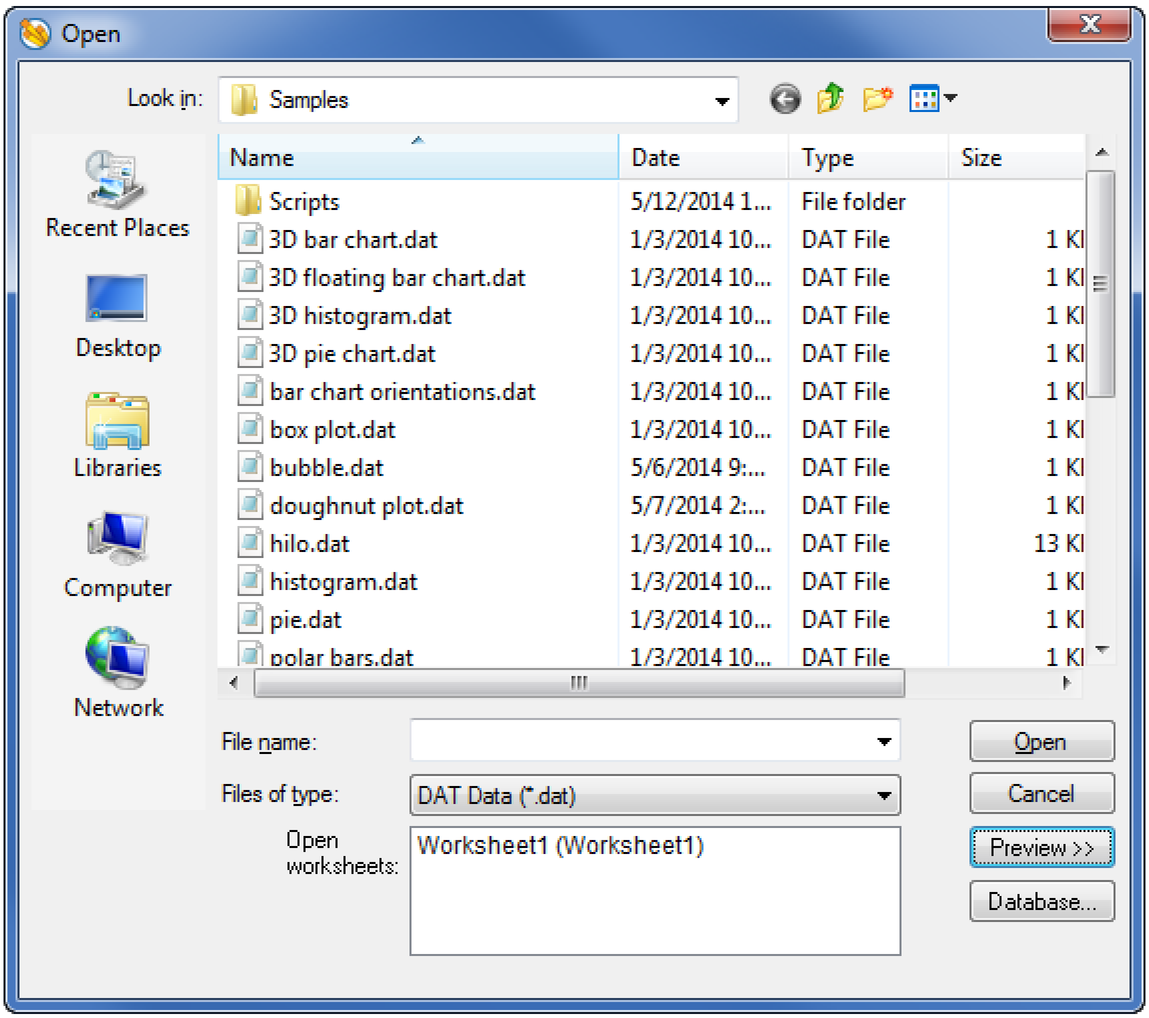
Import

Open

The **File |Open** command opens a file in a new window. Alternatively, click the button to open files. The **Open** dialog options vary depending on how the dialog was accessed.

Open Dialog

The **Open** dialog contains the following options:



*The **Open** dialog contains the options needed to open any file in Grapher.*

Look In

The *Look in* field shows the current directory. Click the down arrow to see the directory structure. Click on the folders to change directories.

The buttons to the right of the *Look in* field allow you to create new folders and change the view of the file list.

File List

The *File list* displays files in the current directory. The current directory is listed in the *Look in* field. The *Files of type* field controls the display of the file list. For example, if DAT Data (*.DAT) is listed in the *Files of type* field, then only .DAT files appear in the files list. To see all files in the directory, choose *All Files (*.*)* from the *Files of type* list. Double-click on a file to open it or single click the file and then click the *Open* button.

File Name

The *File name* field shows the name of the selected file. Type a path and file name into the box to open a file.

Files of Type

The *Files of type* field shows the file format to be opened. To change the file format, click the down arrow and select the file type from the list. *All Files (*.*)* displays all files in a directory; *All Recognized Types (*...)* displays all files that can be opened in the program.

The **Open** dialog remembers which file type was last selected. For example, if you select *DAT Data (*.dat)* next to *Files of type* in order to open a file, only .DAT files are shown the next time the **File | Open** command is used.

Open Worksheets

The *Open worksheets* section displays all open worksheets in the program. Double-click on a worksheet file name to open the file or to use the file in a new graph.

Preview

Graph files can be previewed before opening them. Click the *Preview* button to expand or collapse the preview pane on the right side of the dialog. Clicking on a graph file displays a picture of the graph in the preview pane if a preview picture is available. Only files saved in the **Grapher 5** or later .GRF, .GPJ, or .GRT formats have preview pictures. Files from earlier versions of **Grapher**, non-graph files such as data files, and files already open cannot be previewed. If the file is already open, the preview pane states that the file is already open.

Database

Click the *Database* button to open a database. The Data Link Properties dialog appears.

Open File Types

Grapher Files .GRF
Template Files .GRT
Grapher Project .GPJ
Excel 2007 Spreadsheet .XLSX
Excel 2007 Spreadsheet .XLSM
Excel Spreadsheet .XLS
Microsoft SYLK .SLK
DBF Database .DBF
Access 97-2003 Database .MDB
Access Database .ACCDB
Comma Separated Variables .CSV
ASCII Data .TXT
Data .DAT
Atlas Boundary .BNA
Golden Software Blanking .BLN
Grid Files .GRD, .DEM, .HDR, .DDF, .DT?
LiDAR Binary .LAS .LAZ Files
MapInfo Interchange Format Data MID Files

BLN and BNA Files

If **File | Open** is used to open Golden Software Blanking .BLN or Atlas Boundary .BNA files, the files open into the worksheet. To use the files as graphics in the plot window, use the File | Import command in the plot window.

Opening Multiple Files

Multiple files can be opened at one time using the SHIFT or CTRL keys while selecting files in the **Open** dialog.

Opening Templates

The **Open** dialog has two additional options when opening template files, *Use this worksheet for remaining items* and *Set columns*.

- To use one worksheet for all plots, check the *Use this worksheet for remaining items* box when selecting data files. When using **Open** from automation, the template only uses one worksheet.
- Check the *Set columns* box to select the data columns to use in

the graph. If you have more than one plot in the template, make sure *Use this worksheet for remaining items* is not enabled so you can select the columns for each plot.

Data Link Properties

Open database files in **Grapher** with the **File | Open** command. In the **Open**dialog, click the*Database* button. A new worksheet window will appear. The **Data Link Properties**dialog will open. After stepping through the import process, you can save the new worksheet and the link to the database is removed.

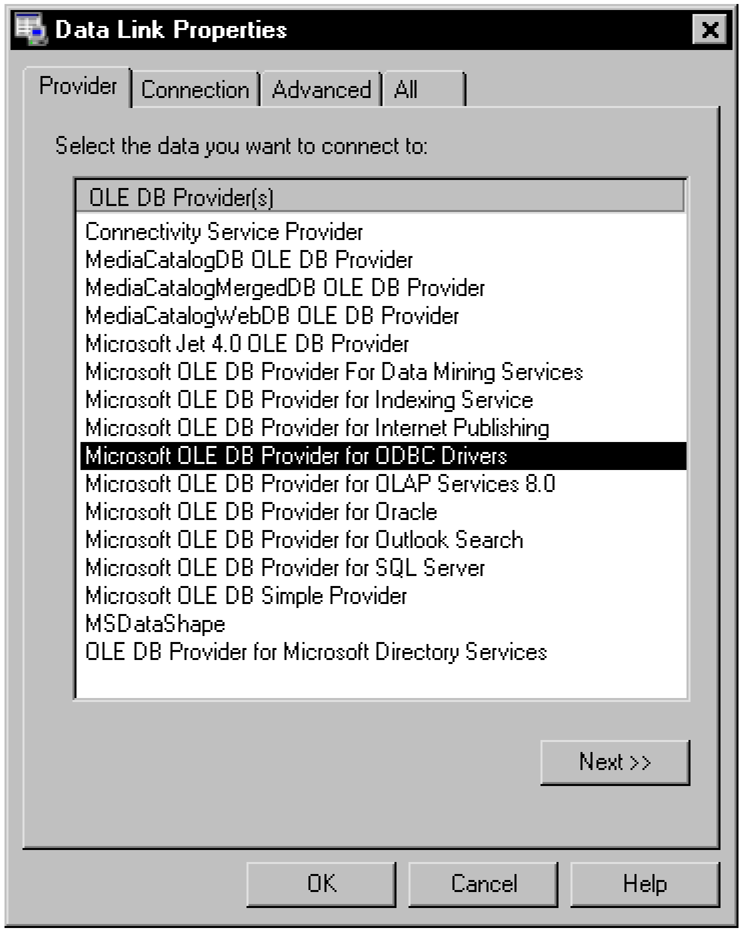
The data linking provides a method to link virtually any database supported by Microsoft via an OLE DB Provider, ODBC, or some other supported format. Because the data link provides to many types of databases that vary by computer, and since this link is provided by Microsoft, only general information is provided here. Click *Help* in the **Data Link Properties** dialog to access Microsoft's help file for this dialog. If you need additional information on specific connection information, contact your network administrator.

ODBC Drivers

Note that ODBC drivers are installed by the database program, not by **Grapher**. If a database program is not installed on the computer, a driver may still be able to be located to import the data from the database. For example, the Microsoft Access database engine can be downloaded from Microsoft's website.

Data Link Properties Dialog

The **Data Link Properties** dialog appears when you click the *Database* button in the **Open** dialog. Data linking is used to define links to many types of databases.



*Use the **Data Link Properties** dialog to define links to a database.*

Help Button

Click the *Help* button in the **Data Link Properties** dialog to access Microsoft's help file for this dialog. If you need additional information on specific connection information, contact your network administrator.

Data Linking

To use data linking,

1. Click the File | Open command. The **Open** dialog is displayed.
2. Click the *Database* button. The **Data Link Properties** dialog opens, with the *Provider* tab active.
3. Step through the dialogs to import the database data.

Provider Tab

Use the **Provider** tab to select the appropriate OLE DB provider for the type of data you want to access. Not all applications allow you to specify a provider or modify the current selection; this tab is displayed only if your application allows the OLE DB provider selection to be edited. You can save a data link with the application itself or as a separate file. For more information about creating a data link, refer to the Microsoft help.

Option	Description
OLE DB Provider (s)	Lists all OLE DB providers detected on your computer. For more information about providers, see "Microsoft OLE DB Providers Overview" in the MDAC SDK.
Next	Opens the Connection tab for the selected OLE DB provider.

Note You can navigate directly to the **Connection** tab by double-clicking the desired provider. For more information about Data Links, see the Data Link API Reference.

Click **Next** or click the **Connection** tab to specify how to connect to ODBC data.

Connection Tab

This **Connection** tab is provider-specific and displays only the connection properties that are required by the Microsoft OLE DB Provider for ODBC.

Option	Description
Use data source name	Select from the list, or type the ODBC data source name (DSN) you want to access. You can add more sources through the ODBC Data Source Administrator. Refresh the list by clicking Refresh.
Use connection string	Allows you to type or build an ODBC connection string instead of using an existing DSN.
Build	Opens the Select Data Source dialog box. Once you select a data source the connection string in that data source will appear in the Connection tab of the Data Link Properties dialog. If you select a File DSN, the resulting ODBC connection string is not based on a DSN. The ODBC connection string is persisted in the data link (.udl) file and does not rely on the selected file DSN.

	If you select a Machine DSN, the resulting ODBC connection string is based on a DSN. The ODBC connection string references the selected machine DSN. If a user on a different system attempts to access the data link (.udl) file, the user must also have the machine DSN installed.
User name	Type the User ID to use for authentication when you log on to the data source.
Password	Type the password to use for authentication when you log on to the data source.
Blank password	Enables the specified provider to return a blank password in the connection string.
Allow saving password	Allows the password to be saved with the connection string. Whether the password is included in the connection string depends on the functionality of the calling application. Note If saved, the password is returned and saved unmasked and unencrypted.
Enter the initial catalog to use	Type in the name of the catalog (or database), or select from the drop-down list.
Test Connection	Click to attempt a connection to the specified data source. If the connection fails, ensure that the settings are correct. For example, spelling errors and case sensitivity can cause failed connections

.

Note For more Data Link connection information, see the Data Link API Reference.

Advanced Tab

Use the **Advanced** tab to view and set other initialization properties for your data.

The **Advanced** tab of the **Data Link Properties** dialog box is provider-specific and displays only the initialization properties required by the selected OLE DB provider. For more information about advanced initialization properties, see the documentation provided with each specific OLE DB provider.

The following table describes most initialization options.

Option	Description
Impersonation level	The level of impersonation that the server is allowed to use when impersonating the client. This property applies only to network connections other than Remote Procedure Call (RPC) connections; these impersonation levels are similar to those provided by RPCs. The values of this property correspond directly to the levels of impersonation that can be specified for authenticated RPC connections, but can be applied to connections other than authenticated RPCs. Select from the following levels: • Anonymous—The client is anonymous to the server. The server process cannot obtain identification information about the client and cannot impersonate the client. • Delegate—The process can impersonate the client's security context while acting on behalf of the client. The server process can also make outgoing calls to other servers while acting on behalf of the client. • Identify—The server can obtain the client's identity. The server can impersonate the client for Access Control List (ACL) checking but cannot access system objects as the client. • Impersonate—The server process can impersonate the client's security context while acting on behalf of the client. This information is obtained when the connection is estab-

	lished, not on every call.
Protection level	The level of data protection sent between client and server. This property applies only to network connections other than RPC connections; these protection levels are similar to those provided by RPCs. The values of this property correspond directly to the levels of protection that can be specified for authenticated RPC connections, but can be applied to connections other than authenticated RPCs. Select from the following levels: • Call—Authenticates the source of the data at the beginning of each request from the client to the server. • Connect—Authenticates only when the client establishes the connection with the server. • None—Performs no authentication of data sent to the server. • Pkt—Authenticates that all data received is from the client. • Pkt Integrity—Authenticates that all data received is from the client and that it has not been changed in transit. • Pkt Privacy—Authenticates that all data received is from the client, that it has not been changed in transit, and protects the privacy of the data by encrypting it.
Connect timeout	Specifies the amount of time (in seconds) that the OLE DB provider waits for initialization to complete. If initialization times out, an error is returned and the connection is not created.

Access permissions	Select one or more of the following permissions: • **Read** - Read only. • **ReadWrite** - Read and write. • **Share Deny None** - Neither read nor write access can be denied to others. • **Share Deny Read** - Prevents others from opening in read mode. • **Share Deny Write** - Prevents others from opening in write mode. • **Share Exclusive** - Prevents others from opening in read/write mode. • **Write** - Write only.

Note For more Data Link initialization information, see the Data Link API Reference.

All Tab

Use the **All** tab to view and edit all OLE DB initialization properties available for your OLE DB provider. Properties can vary depending on the OLE DB provider you are using. For more information about the initialization properties, refer to the documentation provided with each specific OLE DB provider.

Option	Description
Initialization properties list	Lists all properties and their current values.
Edit Value	Opens the Edit Property Value dialog box for the selected property.

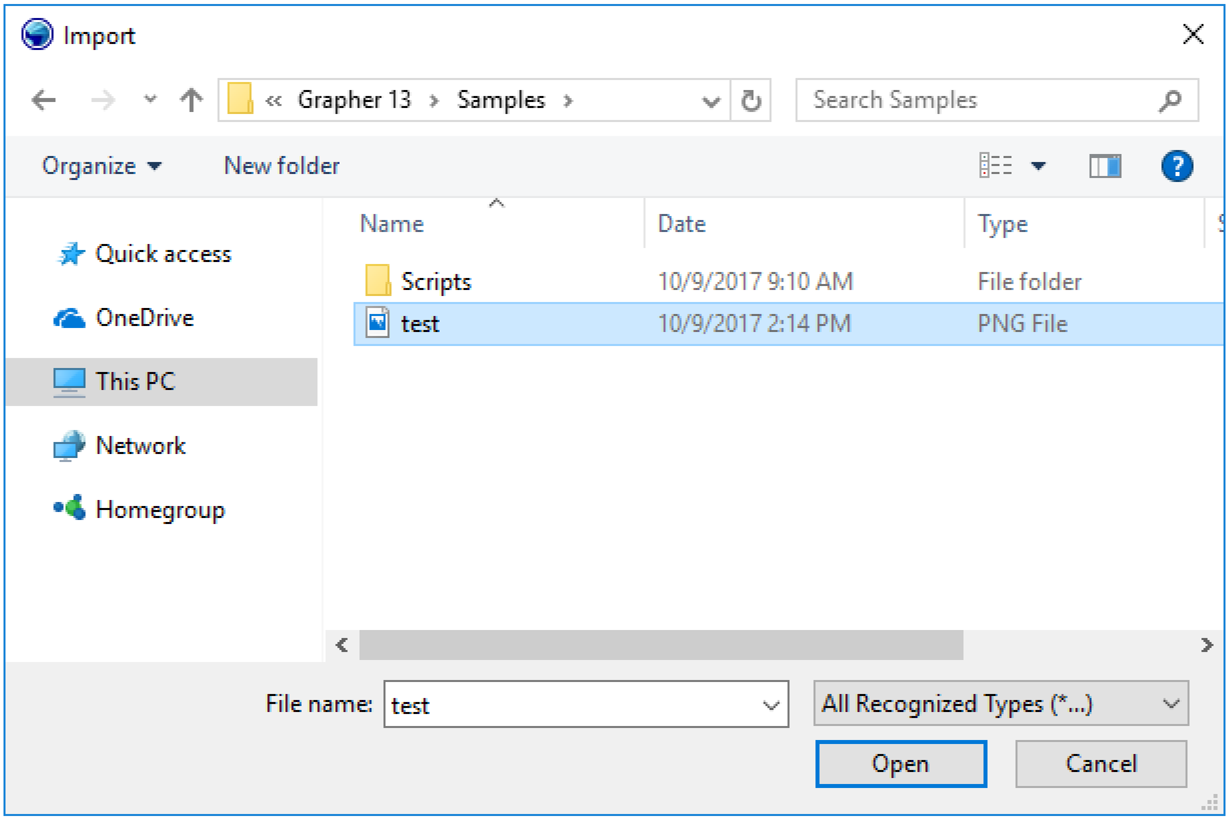
Note You can open the Edit Property Value dialog box by double-clicking the desired property. For more Data Link initialization information, see the Data Link API Reference.

Import

Click the **File | Import** command, the button on the quick access toolbar, or press CTRL+I on the keyboard to open the **Import**dialog. You can import graphic "trim" objects, background graphics, or some form of annotation. You can also import graphics into the plot by clicking the **Insert | Add Graphic** command.

Import Dialog

The **Import** dialog contains the following options:



*The **Import**dialog appears, allowing you to import objects into your**Grapher**project.*

Look In

The *Look in* field shows the current directory. Click the down arrow to see the directory structure. Click on the folders to change directories.

The buttons to the right of the *Look in* field allow you to create new folders and change the view of the file list.

File List

The *File list* displays files in the current directory. The current directory is listed in the *Look in* field. The *Files of type* field controls the display of the file list. For example, if Golden Software Boundary (*.GSB) is listed in the *Files of type* field, only .GSB files appear in the files list. To see all files in the directory, choose *All Recognized Types (*...)* from the *Files of type* list. Double-click on a file to open it or single click the file and then click the *Open* button.

File Name

The *File name* field shows the name of the selected file. Also, a path and file name can be typed into the box to open a file.

Files of Type

The *Files of type* field shows the file format to be opened. To change the file format, click the down arrow and select the file type from the list. *All Types (*.*)* displays all files in a directory and *All Recognized Types (*...)* displays all files that can be imported with **File | Import**.

Formats available with the **Home | IO | Import** command in the plot window:

AN? ACR-NEMA Medical Image [.AN1, .AN2]

BLN Golden Software Blanking File

BMP Windows Bitmap

BNA Atlas Boundary

DICOM3 Medical Image

DDF SDTS TVP

DLG USGS Digital Line Graph [.DLG, .LGO, .LGS]

DXF AutoCAD Drawing

E00 Esri ArcInfo Export Format

EMF Windows Enhanced Metafile

GIF Image

GSB Golden Software Boundary

GSI Golden Software Interchange

JPG Compressed Bitmap

JPEG-2000 Bitmap (.JP2, .J2K, .JPC, .JPT, .JPG2000, .J2000)

MIF MapInfo Interchange Format

PDF Raster

PLT Golden Software PlotCall

PLY Stanford PLY

PNG Portable Network Graphics

PNM/PPN/PGM/PBM Image

RGB SGI-RGB Image
SEG Exchange Format
SHP Esri Shapefile
SID LizardTech MrSID Image
SP1 SEG Exchange Format
SUN Sun Raster Image
TGA Targa (TrueVision)
TIF Tagged Image
VTK Visualization Toolkit
WMF Windows Metafile
X AVS X-Image

Formats available with the **Home | IO | Import** command in the worksheet window:

ACCDB Microsoft Access
BLN Golden Software Blanking File
BNA Atlas Boundary
CSV Comma Separated Variables
DAT Data
DBF Database
MDB Microsoft Access
P1 SEG Data Exchange Format
SEG Data Exchange Format
SLK Sylk Spreadsheet
TXT Text Data
XLS Excel Spreadsheet
XLSX Excel 2007 Spreadsheet
XLSM Excel 2007 Spreadsheet

Resize

Click and drag the lower right corner to change the size of the dialog. The new dialog size is remembered the next time the **File | Import** command is used.

Remarks

BLN and BNA files can be opened in the worksheet. USGS SDTS files may contain raster or vector data.

BLN and BNA Files

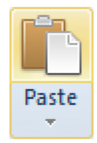
To open Golden Software Blanking .BLN and Atlas Boundary .BNA files in the worksheet, use File | Open rather than **File | Import**.

USGS SDTS Files

There are two separate types of SDTS files. The Topological Vector Profile SDTS files contain boundary line information and can be used as a graphic in **Grapher**. The Raster Profile SDTS files contain gridded elevation information and can be used to create a grid-based surface or contour map in **Grapher**. An uncompressed SDTS contains several files with the .DDF extension. All of the .DDF files are necessary to produce a graphic, i.e., you cannot copy just one .DDF file and create a graphic from it. You can choose any of the .DDF files when importing a base map with the Topological Vector Profile SDTS files.

Paste

Click the **Home | Clipboard | Paste** command or press CTRL+V on the keyboard to paste the clipboard contents into the current document. The objects to be copied must first be placed in the clipboard using the Home | Clipboard | Cut or Home | Clipboard | Copy commands of **Grapher** or some other application. The clipboard contents remain on the clipboard until something new is cut or copied to the clipboard.



*Click the **Paste** button to paste the object to the window.*

Click the down arrow on the **Paste** command to select the Paste Special or Paste Format command.

Plot Window

In the plot window, the pasted object is positioned in the center of the current plot extents.

Worksheet

In the worksheet, the upper left corner of the pasted data is placed in the active cell. Any cells in the existing worksheet that lie to the right of and below the active cell will be overwritten with the contents of the pasted data. The following rules are used to paste into the worksheet:

- Only the TAB character is recognized as a column separator. Spaces, commas, semi-colons, etc. are included in a text cell.
- The RETURN character is recognized as the row separator.
- Numbers paste as number values. The period can always be used as a decimal separator, and the system locale determines any other

decimal separator. For example if the system locale uses a comma as the decimal separator, then both 123.456 and 123,456 are pasted as the number 123,456.

- Mixed text and numbers paste as text.
- Dates and/or times will paste as date values in a wide variety of date/time formats. Ambiguous dates are determined by the system locale setting. If dates are not pasted correctly, consider using Paste Special and the *Locale* settings in the Data Import Options dialog.

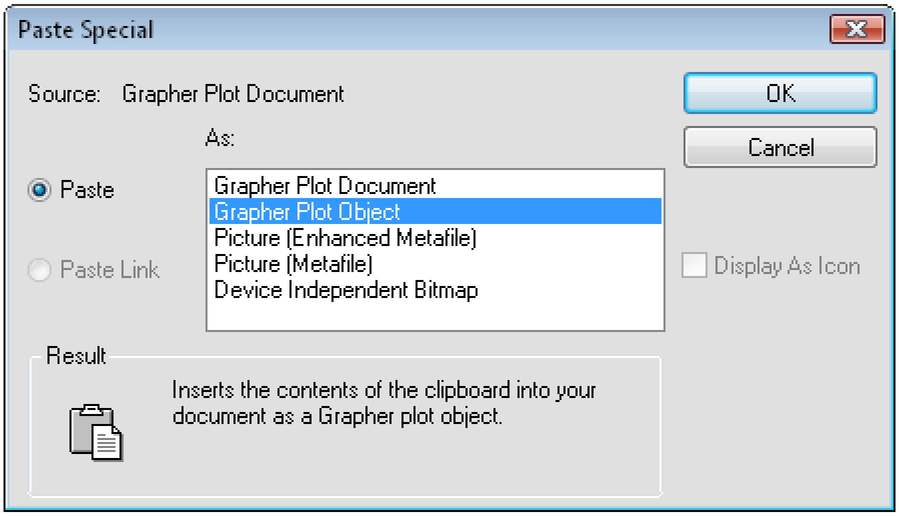
Pasting a Single Cell's Contents Across Multiple Cells

A single cell's contents can be pasted into multiple cells by coping the cell, selecting a block of cells, and using the **Paste** command. Each cell in the selection is populated with the clipboard contents when this operation is performed. If more than one cell is copied then the copied cells are only pasted once.

The multiple paste operation will not be performed for an entire row, entire column, or across multiple selections. When an entire row or column is selected, only the first cell in the row or column will receive the pasted content. If you attempt to paste in multiple selections an error message will be displayed.

Paste Special

Clicking the **Home | Clipboard | Paste | Paste Special** command opens the **Paste Special** dialog, where you have the option of specifying the format to use when pasting the object into **Grapher**. Use the **Home | Clipboard | Paste | Paste Special** command for selecting one of several formats for pasting the clipboard contents. See the *Paste Special - Worksheet* topic for selecting the format when pasting into the worksheet.



*Use the **Paste Special** dialog in the plot window to paste objects from the clipboard.*

Source

Source indicates the program used to create the clipboard contents. For example, if a **Grapher**object is copied to the clipboard, *Grapher Plot Document* appears in the source field. The source can be **Grapher**, *Unknown*, or other software applications. You cannot insert a **Grapher**Plot Document into an existing**Grapher**document.

Paste Type

You can insert an object into the document by pasting or by pasting a link to the object.

Selecting *Paste* embeds an OLE object into the document. Changes you make to the embedded information will not be reflected in the original document, and changes to the original document will not appear in this document.

Selecting *Paste Link* links the object to another software application. Non-OLE objects are pasted as they appeared in the original document and they cannot be edited. Changes you make to the linked information in this file will be reflected in the original file, and changes in the original file will also appear in this file.

When pasting a linked object, the link remains available as long as the information is contained on the clipboard. The link changes to "unknown" if the server application is closed or if new information is copied to the clipboard.

Formats

Paste special format types vary depending on the origin of the clipboard information. The *As* field lists the available formats. Use the *As*field to specify how the information is pasted into your document. You can highlight the clipboard format in the *As* box and then refer to the *Result* box for more information on clipboard format types. This option is not available for some types of documents.

Display as Icon

Display As Icon is available for OLE objects. *Display As Icon* specifies whether the information or an icon representing the information will appear in the file. If *Display As Icon* is checked, an icon appears in the document rather than the complete object. Change the icon and title by clicking the *Change Icon* button. If the box is not checked, the complete object appears in the document. After the icon is displayed in the graph, double-click the icon to show the complete object.

Result

The *Result* section specifies how the contents of the clipboard will be formatted when pasted into the document, based on the selection you made.

OK or Cancel

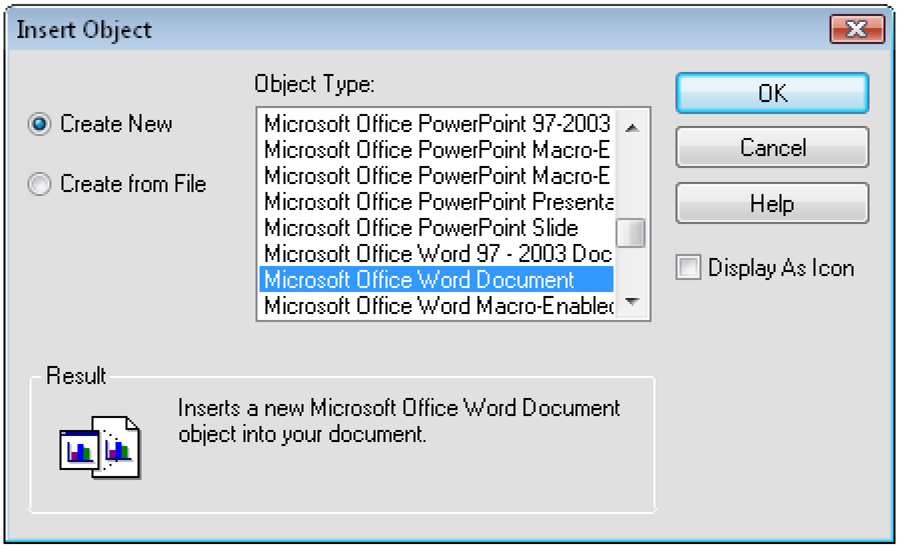
To insert the information into your current document, click *OK.*To exit the dialog without inserting the information into your current document, click*Cancel*.

Insert OLE Object

Click the **Insert | OLE Object** command to open the **Insert Object**dialog. You can also The**Insert Object**dialog can create a new object or import an existing object into the **Grapher** window. The **Insert Object** dialog contains two options: *Create New* and *Create from File*. In both cases, the object is created and edited using the original application’s menus.

Insert Object - Create New

When the *Create New* option is selected, the following options exist in the dialog:



*Use the **Insert Object** dialog to create new objects or import objects.*

Object Type

The *Object Type* list includes all the object types that can be created in the **Grapher** window. For example, a Microsoft Office Word Document can be created in **Grapher**. Choose *Microsoft Office Word Document* from the *Object Type* list, click the *OK* button and an object box appears. Text can be typed and edited just as in Microsoft Word. A **Grapher**Plot Document cannot be inserted into an existing graph.

Result

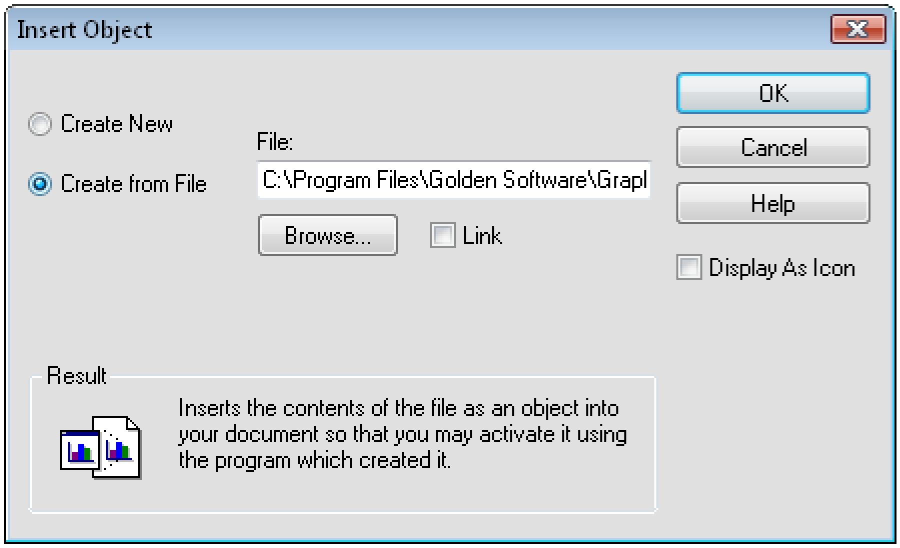
The *Result* box displays the result of creating a new object.

Display As Icon

Check the *Display As Icon* box to display the new object as an icon rather than displaying the full object. If the *Display As Icon* box is checked, click the *Change Icon* button to change the displayed icon and title of the object. Double-click on the displayed icon in the **Grapher**window to open the file.

Insert Object - Create from File

When the *Create from File* option is selected, the following options exist in the dialog:



*Use the **Insert Object** dialog to create new objects or import objects.*

File

The *File* box lists a file path. Type a path and file name or use the *Browse* button to select a file.

Link

If the *Link* box is checked, any changes made to the linked document are updated in **Grapher** and vice versa.

Display As Icon

If the *Display As Icon* box is checked, the object is displayed as an icon rather than as an entire object. If the *Display As Icon* box is checked, click the *Change Icon* button to change the displayed icon and title of the object. Double-click on the displayed icon to open the file.

Result

The *Result* box displays information about the object's type.

OLE

Object Linking and Embedding (OLE) is a feature that allows several software applications to work together. Using OLE allows the use of an object in another application without losing the functionality of the original application. There are two types of OLE objects: linked objects and embedded objects. The linked object is stored within the original application and any changes made to the document in the original application will appear in **Grapher**. Embedded objects are stored in **Grapher**. The object can be edited within **Grapher** using the original application's menu commands, toolbars, etc.

Creating OLE Objects

An OLE object can be created in **Grapher** by clicking the Home | Clipboard | Paste | Paste Special or Insert | OLE Object commands. The **Home | Clipboard | Paste | Paste Special** command copies the object from the clipboard and inserts it into **Grapher**. Both embedded and linked objects can be inserted into **Grapher** as an icon.

Insert New Object

Click the **Insert | OLE Object** command to create a new object or to import a new object into the **Grapher** window. In the **Grapher** window, a box appears in which to create the object, and the menu commands, toolbars, etc. change to the selected object type. For example, to create a Microsoft Word document in **Grapher** click **Insert | OLE Object**, select *Create New*, and then choose *Microsoft Office Word Document* from the object type list. Click the *OK* button. The **Grapher** menu commands change to Word menu commands and the toolbars change to Word toolbars. This allows complete Word functionality within the **Grapher** window. A newly created object is always embedded.

A new object can also be created from a file. For example, to create a new Microsoft Word document in **Grapher**, choose **Insert | OLE Object**, select *Create from File*, click the *Browse* button, and then locate the file to insert. These files can be linked or embedded. Check the *Link* box if you wish to link the object. If the application for the selected file type does not support OLE, then the file is inserted as an icon. This icon can be used to open the original application.

Editing OLE Objects

Double-click on the OLE object to edit it. Embedded objects are edited in the **Grapher** window. All commands in the window change to the original application commands. Linked objects are edited in the original application window. Double-clicking on a linked object opens the original application.

An embedded object appears with diagonal lines across it when it is being edited in the original application window. Choose **File |Save Copy As** in the original application to save changes. Check the original application's **File** menu for **Close and Return to *.GRF** to return the embedded object.

OLE

Edit

Double-click on the OLE object to begin editing. The Property Manager is not used to edit OLE objects.

When a linked object is edited, the object opens in its original application. Make changes to the object in that window, save and close the original application.

When an embedded object is edited, the original application does not open; rather, a dark bounding box surrounds the object and the original application's rulers, toolbars, and menu items appear in **Grapher**. Make changes to the object, and click outside the object to finish editing it.

Rename

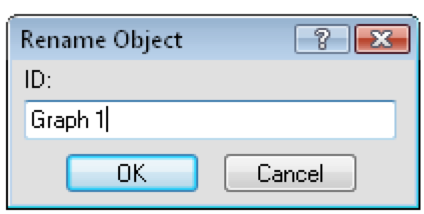
Click the **Home | Selection | Rename** command while an object is selected to change its ID. The **Rename Object** dialog opens.

You may also change an object's ID in one of these ways:

- Right-click on the object in the Object Manager and select **RenameObject**,
- Right-click on the object in the plot window and select **Rename Object**,
- Press F2 on the keyboard,
- Slow double-click on the object in the **Object Manager**, though this does not open the **Rename Object** dialog.

Rename Object Dialog

Select an object and click the **Home | Selection | Rename** command to open the **Rename Object** dialog.



*Use the **Rename Object** dialog to change the object ID.*

ID

Enter a new object name in the *ID*box.

OK or Cancel

Click *OK* to close the **Rename Object** dialog and change the object ID to the new specified *ID*. Click*Cancel*to close the**Rename Object**dialog without making changes to the object*ID*.

Export

Save

If the file has already been saved, click the **File |Save** command or click the  button on the Quick Access Toolbar to update the saved file. If the file has not been saved previously, the Save As dialog appears when **File | Save** is selected.

Saving GRF Files

A Grapher GRF file saves only the graph and plot options and a link to the data file. If the source data for the file has not been saved, a message is displayed asking if you'd like to save the data file. If you close the data file without saving, the data necessary to recreate the graph will be lost. If you wish to embed the source data with the graphs, save a Grapher Project GPJ file instead.

Use Caution when Saving Excel Files!

Use the File | Save To Multi-Sheet Excel File command to save multiple worksheets in a single Excel document.

A file can be saved in an Excel format from **Grapher** worksheet, ***but only one worksheet can be saved*** when using the File | Save or File | Save As command. If a multi-worksheet Excel file is opened and saved as an .XLS or .XLSX file from the **Grapher** worksheet, be aware that only the single worksheet is saved in the document. If the existing file is overwritten, all the unused worksheets are destroyed. In this case, a warning message is issued. The message reads: *Saving this worksheet will destroy all but one of the sheets in the existing *.xls, *.xlsx file. To overwrite the file, click OK. To choose a different file name, click Cancel.*

Saving Files Opened with Open Excel

When saving files opened with the File | Open Excel command, note that the save button on the toolbar does not save the .XLS file. To save the

.XLS file in the Excel window, choose the **File | Save As** command and save to the same file name as the open file. This is a limitation of the Microsoft Excel interface.

Save As

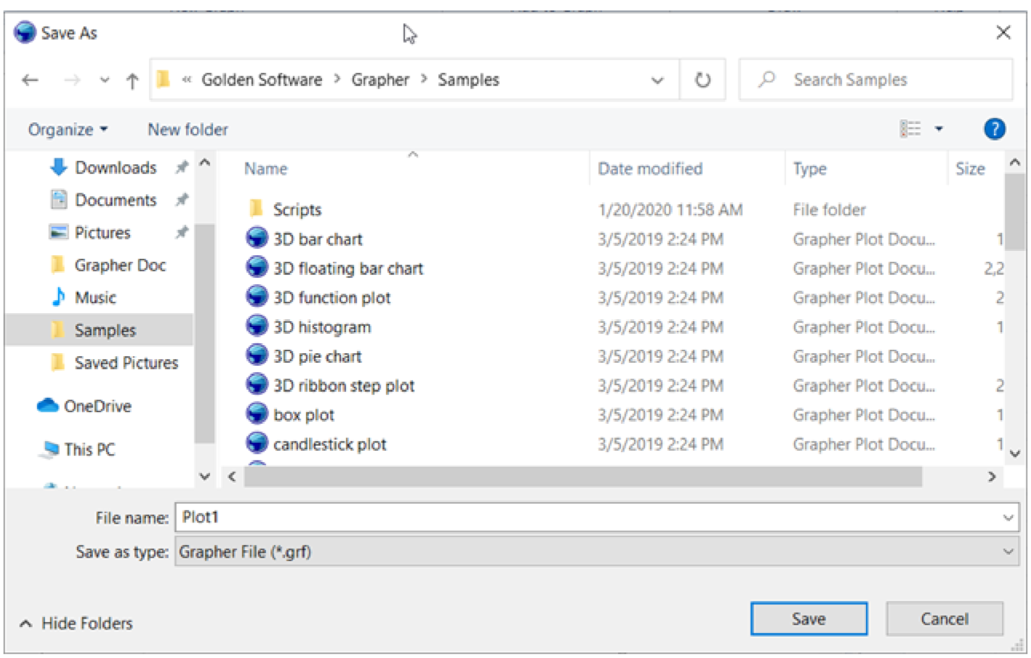
Click the **File | Save As** command to save a new document or save a modified document with a new file name.

Saving GRF Files

A Grapher GRF file saves only the graph and plot options and a link to the data file. If the source data for the file has not been saved, a message is displayed asking if you'd like to save the data file. If you close the data file without saving it, the data necessary to recreate the graph will be lost. If you wish to embed the source data within the saved file, save a Grapher Project GPJ file instead.

Save As Dialog

The **Save As** dialog is displayed after the **File | Save As** command is clicked.



*Set the type of file and file name in the **Save As**dialog.*

Save In

The *Save in* field shows the current directory. Click the down arrow to see the directory structure. Click on the folders to change directories.

The buttons to the right of the *Save in* field allow you to create new folders and change the view of the file list.

File List

The *File list* displays the files using the extension specified in the *Save as type* box. A file can be overwritten by selecting it from the file list.

File Name

The *File name* box displays the name of the selected file. Type the path and file name of the file to be saved.

Select the file format in the *Save as type* box.

The **Save As** dialog now remembers which file type was last selected. For example, if you select *Golden Software Data (*.dat)* next to *Files of type* in order to save a file, the same file type is shown the next time the **File | Save As** command is used.

File Types

Save a document as a *Grapher File .GRF*, *Plot Template .GRT*, or *Grapher Project .GPJ*. Documents can also be saved in backward compatible .GRF and .GPJ files for Grapher versions 10, 11, 12, 13, 14, and 15. Grapher 16 and later versions can open files saved in newer versions. It is not necessary to "save back" to share files when all users have Grapher 16 or later versions.

Save .XLS, .XLSX, .SLK, .CSV, .TXT, .DAT, .BNA, and .BLN in the worksheet.

Export .TIF, .WMF, .DXF, etc by clicking the File | Export command.

Use Caution when Saving Excel Files!

Use the File | Save To Multi-Sheet Excel File command to save multiple worksheets in a single Excel document.

A file can be saved in an Excel format from Grapher worksheet, ***but only one worksheet can be saved*** when using the File | Save or File | Save As command. If a multi-worksheet Excel file is opened and saved as an .XLS or .XLSX file from the Grapher worksheet, be aware that only the single worksheet is saved in the document. If the existing file is overwritten, all the unused worksheets are destroyed. In this case, a warning message is issued. The message reads: *Saving this worksheet will destroy all but one of the sheets in the existing *.xls, *.xlsx file. To overwrite the file, click OK. To choose a different file name, click Cancel.*

File Names, Formats, and File Extensions

When a file is saved, the file format can be specified by typing the appropriate extension on the file name. For example, if the needed file is an ASCII DAT file when saving in the worksheet, type a file name such as MYDATA.DAT. The ".DAT" tells the worksheet to save the file as an ASCII DAT file.

If the extension is not included in the file name, the format is determined by the *Save as type* field. For example, if the name MYDATA is typed in the file name field and the *Save as type* field is set to *Excel Spreadsheet (*.XLS)*, the file is saved as MYDATA.XLS in Excel format.

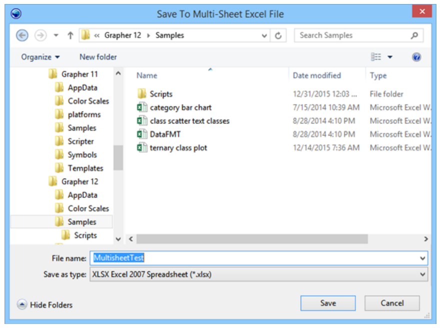
The file can be saved with any extension by enclosing the file name in double quotes. The file is saved with the name and extension typed in the file name box, but it is saved in the format specified in the *Save as type* field. For example, type the name (with quotes) "MYDATA.ABC" in the file name box. If the *Save as type* field is set to *Comma Separated Variables (*.csv)*, the file is saved as MYDATA.ABC in the CSV format.

Save To Multi-Sheet Excel File

Click the **File | Save To Multi-Sheet Excel File** command to save some or all of the open worksheets to a multi-sheet Excel XLSX file. Select a file name and location in the **Save To Multi-Sheet Excel File** dialog. Then specify which open worksheets are included in the saved file in the **Multi-Sheet Export Selection** dialog. The active window must be a worksheet window to use the **Save To Multi-Sheet Excel File** command. The command is disabled when the active window is a plot document.

Save To Multi-Sheet Excel File Dialog

The **Save To Multi-Sheet Excel File** dialog is similar to the Save As dialog.



Specify the file name and location in the ***Save To Multi-Sheet Excel File*** *dialog.*

Save In

The *Save in* field shows the current directory. Click the down arrow to see the directory structure. Click on the folders to change directories.

The buttons to the right of the *Save in* field allow you to create new folders and change the view of the file list.

File List

The *File list* displays the files using the extension specified in the *Save as type* box. A file can be overwritten by selecting it from the file list.

File Name

The *File name* box displays the name of the selected file. Type the path and file name of the file to be saved. Select the file format in the *Save as type* box.

File Type

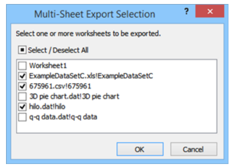
When saving a multi-sheet Excel file, the *Save as type* field is *XLSX Excel 2007 Spreadsheet (*.xlsx)*.

Save and Cancel

Click *Save* to continue to the **Multi-Sheet Export Selection** dialog. Click *Cancel* to close the dialog without saving the worksheets.

Multi-Sheet Export Selection Dialog

Select which open worksheets will be included in the saved multi-sheet Excel file in the **Multi-Sheet Export Selection** dialog.



*Select the worksheets you wish to save and edit the sheet names in the **Multi-Sheet Export Selection** dialog.*

Worksheet List

The **Multi-Sheet Export Selection** dialog displays a list of open worksheets. The check box indicates whether the sheet will be included in the output file. The list displays the worksheet file name to the left of the exclamation point ' ! '. The sheet name with which the worksheet will be saved is displayed to the right of the ' ! '.

By default the sheet name is the file name for single sheet Excel files and other data file types. The sheet name is the same for multi-sheet Excel files that are open in the worksheet.

Selecting Worksheets

Click a worksheet name or check box in the worksheet list to check or uncheck the box. Worksheets with a check will be included in the output Excel file. Select or deselect multiple contiguous sheets by clicking the first desired sheet. Next hold SHIFT and click the last desired sheet. The boxes are either all checked or all unchecked between the clicked sheets.

Click the *Select / Deselect All* check box to change the selection between all sheets and no sheets. The *Select / Deselect All* check box will display a check when all sheets are selected, a black square when some sheets are selected, and nothing when no sheets are selected.

OK and Cancel

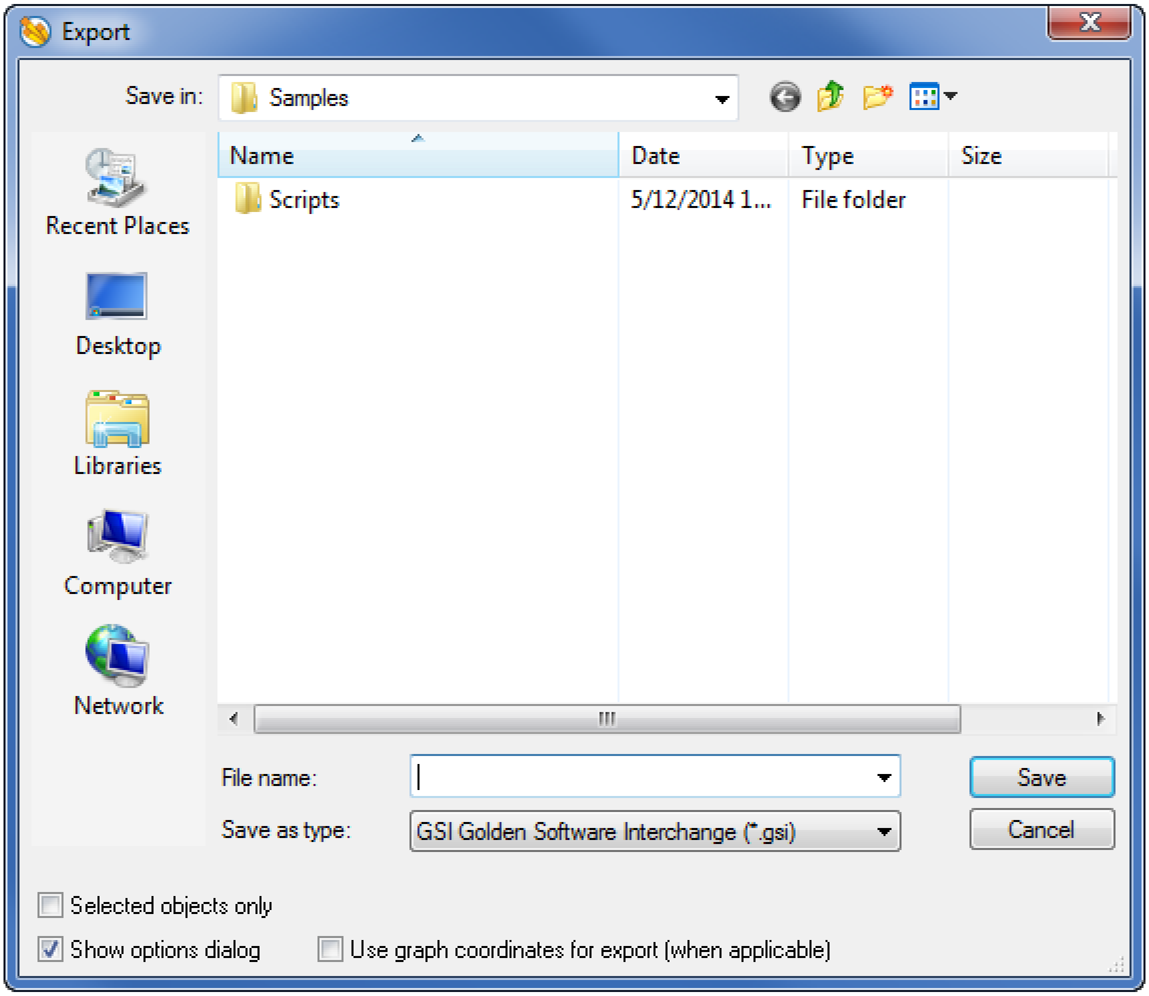
Click *OK* and the multi-sheet XLSX file is created. Click *Cancel* to close the dialog without saving the worksheets.

Export

Click the **File | Export** command, the  button on the quick access toolbar, or press CTRL+E on the keyboard to export files for use in other programs.

The Export Dialog

The **Export** dialog contains the following options:



*The **Export** dialog allows you to export files for use in other programs.*

Save In
The *Save in* field shows the current directory. Click the down arrow to see the directory structure. Click on the folders to change directories.

Folders/View
The buttons to the right of the *Save in* field allow you to create new folders and change the view of the file list.

Files List
The *Fileslist* displays the files using the extension specified in the *Save as type* box. A file can be overwritten by selecting it from the file list.

File Name

The *File name* box displays the name of the selected file. Type the path and file name of the file to be exported.

Save As Type

The *Save as type* box specifies the format of the file to be exported.

The **Export** dialog now remembers which file type was last selected. For example, if you select *PNG Portable Network Graphics (*.png)* next to *Save as type* in order to save a PNG file, the same file type is shown the next time the **File | Export** command is used.

Selected Objects Only

Check the *Selected objects only* box to export selected objects rather than the entire plot.

Show Options Dialog

Check the *Show options dialog* box to display the options dialog for the selected format after clicking the *Save* button.

Use Graph Coordinates for Export

Check the *Use graph coordinates for export (when applicable)* box to use graph coordinates to scale the export if a single graph is exported. Not all graph types are supported.

Resize

The **Export** dialog can be resized. Click and drag the lower right corner to change the size of the dialog. The new dialog size is remembered the next time the **File | Export** command is used.

Exporting Files

Export files by typing a name into the *File name* box and then selecting the file type in the *Save as type* list. For example, typing MYPLOT in the *File name* box and choosing *Tagged Image (TIFF)* from the *Save as type* list results in MYPLOT.TIF. There is no need to type an extension because it is automatically added. If a file extension is typed in the box along with the file name, the file type is determined by the typed extension. For example, if MYPLOT.DXF is typed in the *File name* box, the resulting file is in the AutoCAD DXF format, no matter what is set in the *Save as type* field.

Export Data

Use the **Graph Tools | Plot Tools | Export Data** command to generate a data file from error bars, histogram, fit, function plot, polar function, rose diagram, or wind chart. Surface maps and contour maps generate grid files. If you wish to export data points from the plot, see the Export Data Points from the Plot.

To export the data:

1. Create a fit, display error bars, or create one of the plots mentioned above. The plots can be 2D or 3D.
2. Select the fit or plot.
3. Click the **Graph Tools | Plot Tools | Export Data** command.
4. If a fit curve was selected, set the desired settings in the **Export Data** dialog and click *OK*.
5. A worksheet opens with the data.

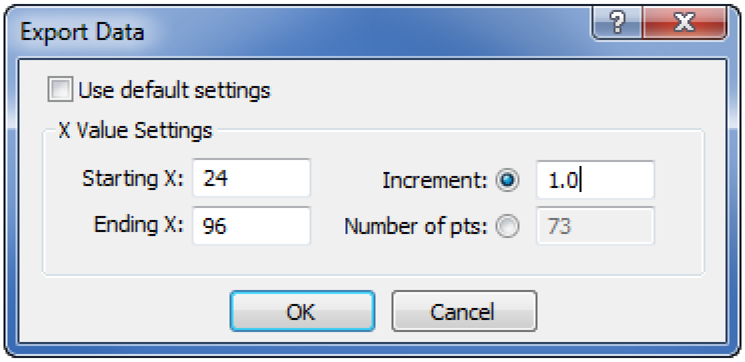
If you are exporting a fit, function, or polar function, the X, Y locations are displayed.If you are exporting histogram or rose diagram data, the worksheet displays the range (bin size), count (number of points in each bin), upper bin limit, and cumulative frequency (current count plus the previous bin's counts). If you are exporting wind chart data, the file also includes the number of data in each wind speed bin.

To export error bar values, click on the line/scatter plot or bar chart to select it. Click the **Graph Tools | Plot Tools | Export Data** command. A worksheet is created with the X values, vertical error bar deviations, and vertical average value or Y values, horizontal error bar deviations, and horizontal average value for each error bar in the plot.

You can use the **File | Save**command to save the data in the worksheet.

Export Data Dialog

The **Export Data** dialog controls the starting and ending X values when exporting a fit curve. The increment and number of points can also be set.



Set the Starting X, Ending X, Increment, *and* Number of pts *in the* ***Export Data*** *dialog.*

Default Settings

Check the box next to the *Use default settings* option to use the Grapher defined values. Grapher uses the smallest number of points to recreate the plot, using the entire X limits. Uncheck the box to set the X values, increment, or number of points separately.

Starting X and Ending X

When the *Use default settings* option is unchecked, the *Starting X* and *Ending X* values can be entered. The *Starting X* value is the first value that should be created in the worksheet. Data with an X value before the *Starting X* value is not exported. The *Ending X* value is the last value that should be created in the worksheet. Data with an X value after the *Ending X* value is not exported. To change either the *Starting X* or *Ending X*, highlight the existing value and type the desired value.

Increment

The *Increment* sets the number of X units that are between exported rows. For example, if the *Starting X* is 24 and the *Increment* is 1, X values are exported starting at X=24 value and then every integer value after (X=25, 26, 27, etc.). The *Increment* and the *Number of pts* work in connection with each other. Changing one automatically changes the other.

Number of Points

The *Number of pts* sets the number of X values that are exported. The *Increment* is automatically calculated to the closest value so that the number of units between X values is constant for all data. For example, if the *Starting X* is 24 and the *Ending X* is 29 and the *Number of pts* is 5, the X values exported are X=24, 25.25, 26.5, 27.75, and 29. The *Starting X* and *Ending X* are always exported. The *Increment* and the *Number of pts* work in connection with each other. Changing one automatically changes the other.

OK and Cancel

Click *OK* to export the data with the selected options. Click *Cancel* to cancel the export. No worksheet is created when *Cancel* is clicked.

Export Data Points from the Plot

Exporting an XYZ Points data file creates a data file with every visible object's vertices as X, Y points. This process can be used to quickly export a plot's data points. If you wish to export the data from error bars, histograms, fits, function plots, polar functions, rose diagrams, or wind charts, see the Export Plot Data topic. The following steps demonstrate how to export the data from a plot.

1. Turn off the visibility for all objects except the plot or plots you wish to export. Click the check box in the Object Manager to turn visibility on or off. Be sure to hide any axes, text, or drawn objects.
2. Click the File | Export command.
3. In the **Export** dialog, check the *Use graph coordinates for export (when applicable)* check box.
4. In the **Export** dialog, change the *Save as type* to either *CSV XYZ points (*.csv)* or *DAT XYZ points (*.dat, *.txt, *.xyz)*.
5. In the *Save in* and *File name* fields, enter the desired file location and name.
6. In the **Export Options** dialog Scaling page, notice that the *File Rectangle* coordinates are the graph limits. If they are not, verify that the *Use graph coordinates for export (when applicable)* box was checked in the **Export** dialog.
7. Click *OK* in the **Export Options** dialog.

An XYZ Points data file is created from the points in the visible plot. Some plots cannot automatically update the *File Rectangle* values in the **Scaling** page when the *Use graph coordinates for export (when applicable)* is checked. When this is the case, you can use the **Layout | Size** and **Layout | Position** values to determine the appropriate values for the *Page Rectangle*. Use the axes' *Limits* to determine the appropriate *File Rectangle* values.

Printing

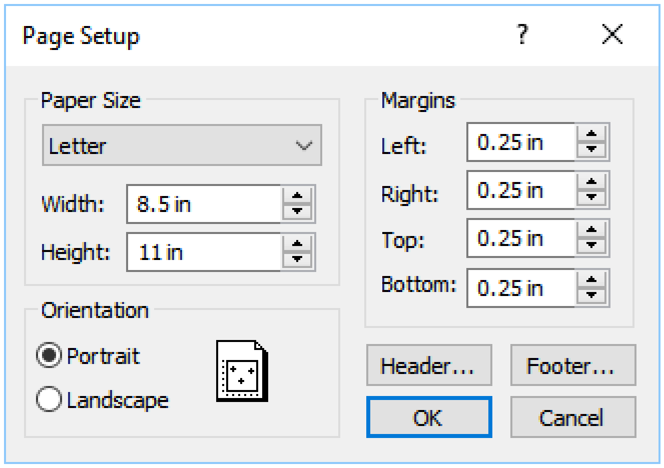
Page Setup

The**File | Page Setup** command in the plot window formats the document for printing. This includes paper size, orientation, margins, and a header and footer.

Page Setup Dialog

There are multiple ways to open the **Page Setup** dialog:

- Click the **File | Page Setup** command.
- Right-click on the plot window and click **Page Setup**.
- Click the **Layout | Page Setup | Margins | Custom** command.
- Click the **Layout | Page Setup | Size | More Sizes** command.



*Set page setup preferences in the **Page Setup** dialog.*

Paper Size

The *Paper Size* options control the size of the paper. Click the down arrow next to the *Paper Size* to select different paper dimensions. There are several predefined page sizes, including *Letter, Tabloid/Ledger, Legal, Executive, A0, A1, A2, A3, A4, A5, B0, B1, B2, B3, B4,* and *B5*. For custom paper sizes, select *Custom* from the list and change the paper size in the *Width* and *Height* boxes.

Quickly select the **Letter** (8.5"x11"), **Legal** (8.5"x14"), **Tabloid/Ledger** (17"x11"), or **A4** (210mm x 297mm) paper size by clicking the **Layout | Page Setup | Size** command.

Orientation

The *Orientation* group controls whether the page is set to *Portrait* or *Landscape* mode. Select *Portrait* to have a vertical page. Select *Landscape* to have a horizontal page.

Margins

Use the *Margins* group to set the page margins for all sides of the printed page. The default *Margins* are 0.25 inches (6.35 mm). Set the *Left*, *Right*, *Top*, and *Bottom* values in inches to any limits the printer will allow. Change the margins by entering new numbers into the *Left*, *Right*, *Top*, and *Bottom* boxes, or use the arrow buttons to scroll to new numbers.

Quickly select **Normal**, **Narrow**, **Moderate**, or **Wide** margins by clicking the **Layout | Page Setup | Margins** command. **Narrow** is the default selection. **Normal** margins are 0.5 inches. **Moderate** margins are 0.5 inches at the *Top* and *Bottom* and 0.75 inches at the *Left* and *Right*. **Wide** margins are 0.5 inches at the *Top*and*Bottom*and 1.0 inches at the*Left*and*Right*.

Setting the margins does not move an existing graph on the page. Margins can be displayed on the page by selecting **Layout | Display | Margins**.

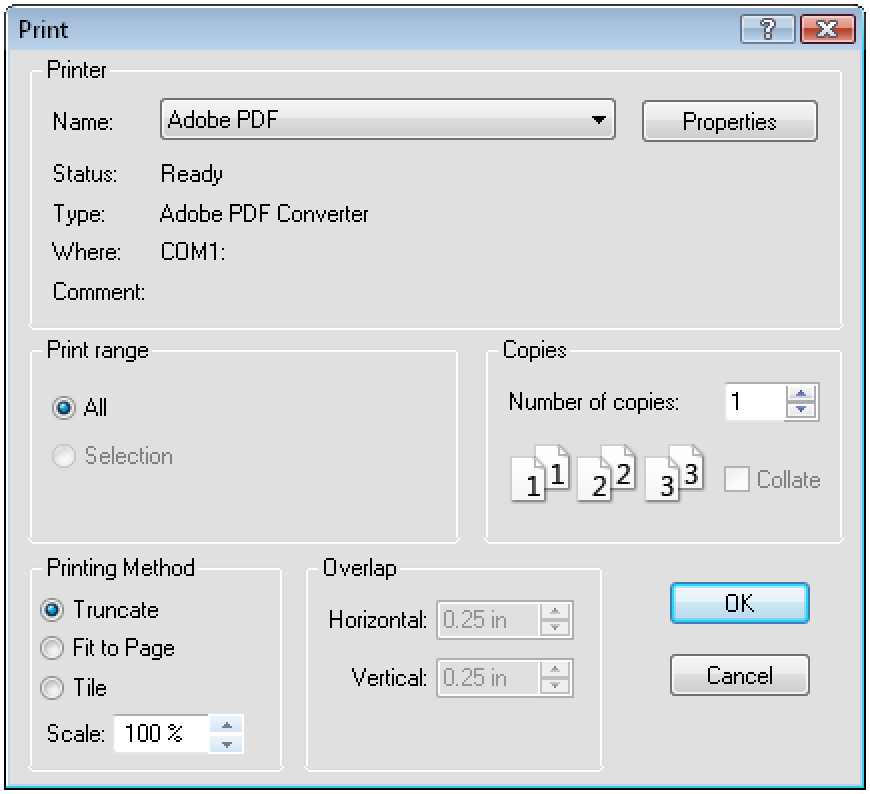
Header & Footer

The *Header* and *Footer* buttons are used to display a header (top) or footer (bottom) in the plot document. The headers and footers are printed inside the top and bottom page margins. Click *Header* to set header text and alignment in the Text Editor. Click *Footer* to set footer text and alignment in the Text Editor.

The header and footer are displayed in the plot window. By default the header and footer are not included in exported output. To include the header/footer in exported output, check the *Export header/footer* check box in the **Options** dialog General page.

Print

Click the **File | Print** command or click the  button to print the active document.



*This is the **Print** dialog.*

Printer

The *Printer* options specify which printer to use.

- The default printer is listed in the*Name*field. If more than one printer is installed on the computer, use the down arrow to the right of the name field to select a different printer.
- The *Properties* button controls the printer settings. For information on specific printer settings, see the owner's manual for the printer.

Print Range

The *Printrange* options control how the document pages are printed.

- *All* prints all the pages that contain objects.
- *Selection* prints the selected objects.

Copies

Copies specify the number of copies to print. If two or more copies of multiple page documents are printed, check the *Collate* box to separate the copies into packets.

Printing Method

The *Printing Method* options control how the document is printed on the page.

- *Truncate* clips objects that extend past the margins.
- *Fit to Page* reduces the size of the plot so that it fits within the specified margins. Margins are set in File | Page Setup, and displayed through File | Options.
- *Tile* breaks the drawing into page size pieces and generates multiple pages of output. Each page overlaps adjacent pages by the amount specified in the horizontal and vertical *Overlap* fields.
- *Scale* is used with the *Truncate* and *Tile* print methods to reduce or increase the overall size of the drawing. 100 percent is actual size, 200 percent is twice as large, and 50 percent is half as large.

Cancel Printing

Click the *Cancel* button in the **Printing** dialog to cancel a print job.

Print Multiple

Click the **File | Print Multiple** command to print the same template .GRT file with multiple data files. All data files must be in the same directory and contain data in the same columns. This command uses the current settings in Page Setup including the default printer.

To print one graph with multiple data files:

1. Click the **File | Print Multiple** command. The **Select Template** dialog opens.
2. Select a .GRT file and click the *Open* button.
3. Select all of the data files you wish to use with the template in the **Select Worksheets** dialog. You can select multiple data files using the CTRL and SHIFT keys. All data files must contain data in the same columns.
4. Click the *Open* button in the **Select Worksheets** dialog to begin printing the graphs.

Options

Click the **File |Options**command to change the program options, such as ruler display or if back up files are created. The**File | Options**command also controls default line, fill, symbol, font, or digitize format properties. These properties are shared by all objects that use the specific format. For example, if you change the line color, all new axes, line/scatter plots, drawn polygons, lines, etc. will have the new line color. Use theFile | Defaults command to change the default properties for basic objects, graphs, plots, axes, and legends.

Options Dialog

Use the **File | Options** command to open the **Options** dialog. Use the **Options** dialog to set preferences for general options (i.e. general, backup, update), environment options (i.e. display, rulers and grids, selection, plots, **Property Manager**), and defaults (i.e. line, fill, symbol, font, and digitize format). Change the listed option as desired and click the *OK* button to save your changes.

Expand the three sections (*General, Environment, Defaults*) in the **Options**dialog to display the following options.

General	Sets basic window feature settings for General, Updates, Backup
Environment	Sets basic environment feature settings for Display, Rulers and Grid, Selection, Plots, and Dialog Messages
Defaults	Sets basic default properties for Line, Fill, Symbol, Font, and Digitize Format

Expanding Options

Left-click the ⊞ button to the left of an option to expand the detailed options.

Condensing Options

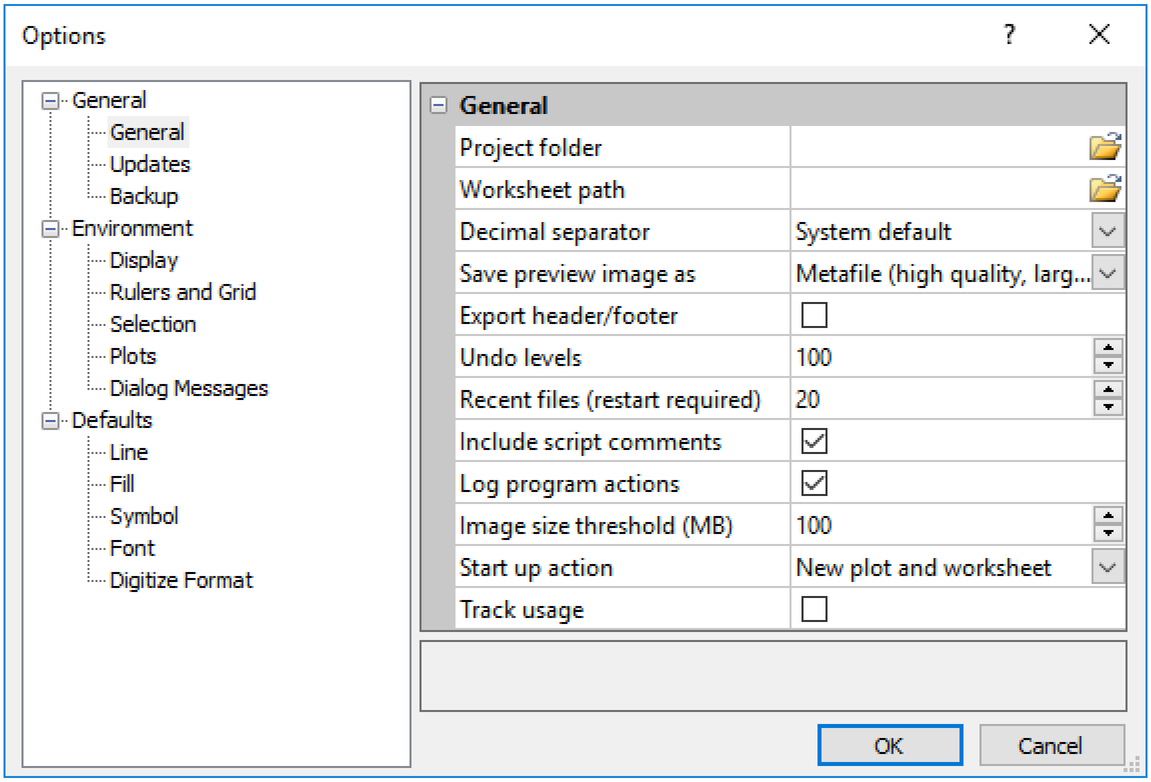
Left-click the ⊟ button to the left of an option to condense the detailed options.

Options - General

You can set defaults such as file open/save paths, page units, undo levels, through the File | Options command. In the **Options** dialog, click the ⊞ button next to *General* to expand the *General* section to access these items.

Changes made in the **Options** dialog affect all subsequent documents. Existing documents and settings are not changed.

The **General** section has the following sub-sections: **General**, Updates, and Backup. Click *General* on the left side of the dialog to display the *General* options on the right side of the dialog. Use the *General* options to control general preferences in **Grapher**.



Use the **Options** *dialog to set* **Grapher** *preferences.*

Project Folder

Use the *Project folder* box to set the default path for opening and saving files. Often the path in the **Open** dialog is set to the path of the currently active file. However, if the active file's path cannot be determined or is not applicable, the *Project folder* is used. If the file path is changed in the dialog, subsequent opens within the same session will use the changed folder.

Click the button to open a dialog and select a directory on the computer. Alternatively type a folder path in the *Project folder* field to set the *Project folder*. If no folder is specified, the Windows default (C:\Users\<username>\Documents) folder is used until a project folder is selected.

The *Project folder* option can also be set in the Welcome to Grapher dialog.

Worksheet Path

Use the*Worksheet path*box to specify where to search for any worksheets used by plots when **Grapher**is opening files. It can be an absolute or relative path, and this setting overrides the path stored within the file for the worksheet.

For example:

- C:\GS\Data Files is an absolute path. **Grapher** looks to the absolute path first for any needed worksheet files, e.g., C:\GS\Data Files\sample4.dat.
- .\Data Files is a relative path (notice the prefix period). Relative paths are modified by the location of the .GRF file being opened, e.g., the act of opening a graph located at C:\Work\MyGraph.grf would result in **Grapher** looking in C:\Work\Data Files for any needed worksheets.

If the *Worksheet path*box is left blank or the data file cannot be found using either the relative or absolute options, the normal search routine occurs. The normal search looks first for the stored worksheet path in the .GRF file, then in the same directory location as the .GRF file. If the *Worksheet path*option is used, then that entry is used first, followed by the normal search routine if necessary.

Click the button to open a dialog and select a directory on the computer.

Decimal Separator

The *Decimal separator* controls which character is used to separate the whole number portion from the decimal portion in a number. To change the *Decimal separator*, click on the existing option and select the desired option from the list. Available options are: *System default*, *Period*, and *Comma*. The default is to use the *System default*. *System default* defers treatment of decimal separators to Windows. The *Period* option displays a period (.) to separate the numbers before and after the decimal. The *Comma* option display a decimal comma (,) to separate the numbers before and after the decimal. When this option is changed, all graphs that are opened will display the selected character for the decimal separator.

When using *System default*, the setting is controlled by Windows. To set the Windows local, in the Windows Control Panel, under *Region and*

Language, set the *Format*. In locale's where the period is the separator, it will be used in **Grapher**. In locale's where the comma is the separator, it will be used in **Grapher**. All .GRF, .GPJ, and .GRT files will use the format specified by Windows. This means that older files may appear differently depending on the format. Some changes may be in axis labels.

The *Decimal separator* is mainly used to import data files from different locales correctly in your instance of **Grapher**. For example, a CSV file uses the period (.) for the decimal separator and a comma (,) for the data delimiter in the English locale. However a CSV file uses the comma (,) for the decimal separator and a semicolon (;) for the data delimiter in the German locale. You can correctly import data files from other locales by updating your *Decimal separator* setting. This means it is not necessary to update your Windows locale to import and open data files from other locales.

Save Preview Image

A preview image is saved with **Grapher** .GRF and .GPJ files and displayed when selecting the **File | Open** command. You can choose the preview image options in the *Save preview image as* drop-down list.

- Select *Do not save preview image* if you do not want a preview image saved with the .GRF or .GPJ file. The file is smaller with this option. This is a good choice if your file size is large, memory is small, and you do not wish to see a preview image when opening the file.
- Select *Metafile (high quality, larger file)* to save a high-resolution preview image to the .GRF or .GPJ file. This is the largest file size option. This can occasionally lead to out of memory errors when saving extremely large files. This is the default setting.
- Select *Bitmap (low quality, smaller file)* to save a low-resolution preview image to the .GRF or .GPJ file. This is a good option if the file size is a considering factor and you want to see the preview image when opening the file.

Export Header/Footer

Check the *Export header/footer* box to include the header and/or footer when exporting the document. Clear this option to export the document without the header and/or footer. You can add a header or footer to the document with the File | Page Setup command.

Undo Levels

You can set the number of Undo levels by changing the number in the *Undo levels* field. Set the *Undo levels* value to a number between 0 and 200. The default *Undo levels* value is 100. Increasing the *Undo levels* value lets you use the **Undo** command more but uses more memory. If you need to free up memory, decrease the *Undo level* value.

Recent files (restart required)

The *Recent files (restart required)* option controls the number of recent files listed in the **File** menu. Set this to a value between 0 and 40. You must restart **Grapher** for a change in this setting to take effect.

Include Script Comments

Check the *Include script comments* box to include comments when recording a script.

Log Program Actions

Check the *Log program actions* option to automatically log **Grapher** command and property actions for the current session in a script file, LogScript.BAS. This feature is used to track potential problems in the program. LogScript.BAS is not sent to Golden Software without your consent. LogScript.BAS is saved when **Grapher** closes and is overwritten each time **Grapher** starts.

Image Size Threshold

The *Image size threshold (MB)* option controls the number of megabytes that can be used before switching images to disk-based images. This option can be set to a value between 0 and 32768. If an imported image is larger than the image threshold, it will be stored in a tiled bitmap format which uses minimal internal memory but can result in some performance degradation. Increase this value if your computer has a lot of internal RAM. Lower this value if you are experiencing very sluggish performance, "Out of memory" errors, or crashes when using large images. Any images already imported must be re-imported to change their internal storage format.

Start Up Action

The *Start up action* controls what happens when a new **Grapher** instance is opened and the Welcome dialog is closed without selecting an option or the **Welcome** dialog is not displayed. The *Start up action* is overwritten by clicking a button in the **Welcome** dialog. If you click the *Close* button or the X button in the top right of the **Welcome** dialog, the most recent action will be used.

Since clicking buttons in the **Welcome** dialog overwrites the *Start up action* setting, the *Start up action* setting should be set after the *Show Welcome dialog* option is cleared on the Dialog Messages page. In this way, you can select the state in which **Grapher** should start when the **Welcome** dialog is not displayed.

To change the default *Start up action*, click on the existing option and select the desired option. Available options include: *New plot and worksheet, New plot, New template, New worksheet, Open file, New plot from template, Launch Wizard,* or *Do nothing*.

- *New plot and worksheet* opens a new empty plot window and new empty worksheet window. This is how older versions of **Grapher** always opened. This is similar to using the **File | New | Plot** command and the **File | New | Worksheet** command or clicking the and buttons.
- *New plot* opens a new empty plot window. This is similar to using the **File | New | Plot** command or clicking the button.
- *New template* opens a new empty template window. A template can be saved and used later to create graphs with the same basic settings. This is similar to using the **File | New | Template** command.
- *New worksheet* opens a new empty worksheet window. This is similar to using the **File | New | Worksheet** command or clicking the button.
- *Open file* opens the Opendialog as soon as Grapher opens. You can select any Grapher file or worksheet file to open. The default directory is set by the *Project folder* option. This is similar to using the **File | Open** command or clicking the button.
- New plot from template creates a new empty plot window from an existing template. This is similar to using the **File | New | Plot from Template** command. After clicking the New plot from template button, the **Open** dialog appears. Select the Grapher template GRT file and click Open. Select each data file required to open the template and click Open. The template appears with the desired data.
- *Launch Wizard* opens a new empty plot window with the graph wizard dialog open. This is similar to using the **Graphs | Create | Graph Wizard** command. This allows an easy method to create a default graph. The wizard has settings to create every plot type.

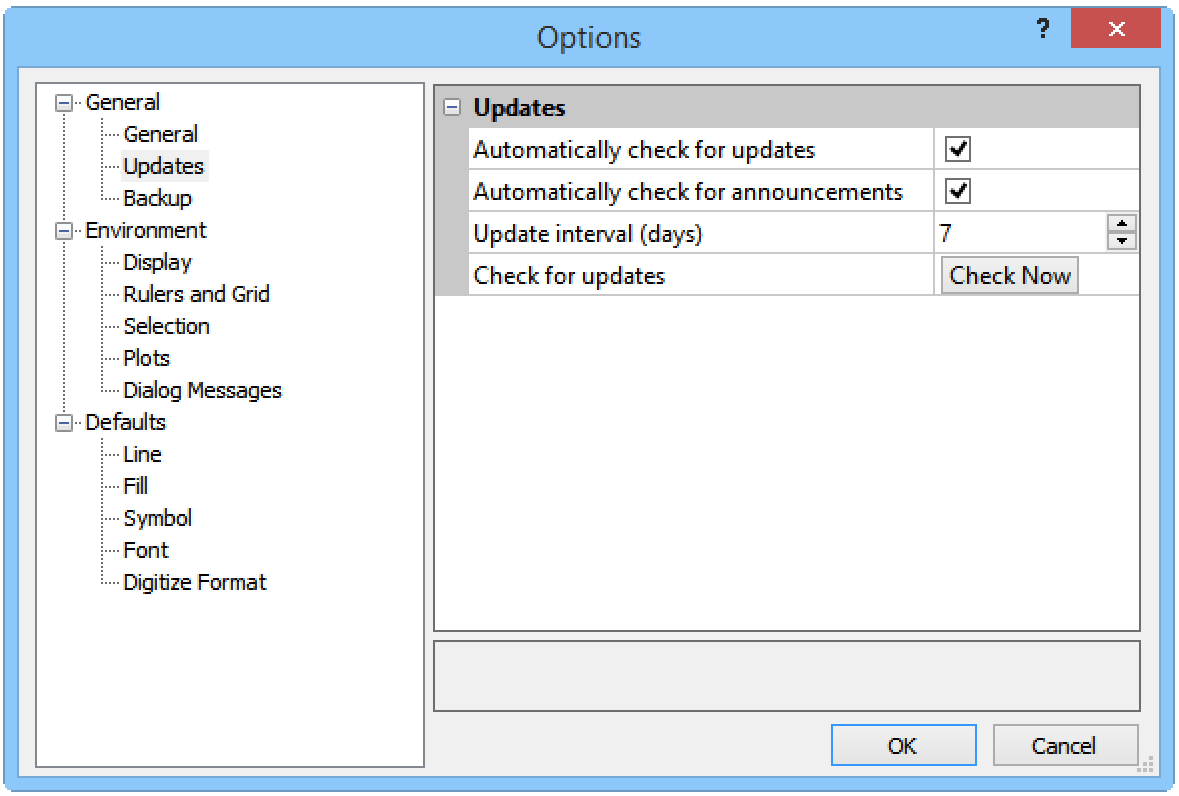
Track Usage

Check the box next to *Track usage* to allow **Grapher** to send anonymous usage data to Golden Software. Sending usage data will help improve **Grapher** to meet our users' needs. This property does not have a default setting; it's initial setting is determined based on your selection to opt-in or opt-out of the Customer Experience Improvement Program during the **Grapher** install process.

Options - Updates

You can set defaults such as file open/save paths, page units, undo levels, through the File | Options command. In the **Options** dialog, click the ⊞ button next to *General* to expand the *General* section to access these items. Changes made in the **Options** dialog affect all subsequent documents. Existing documents and settings are not changed.

The **General** section has the following sub-sections: General, **Updates**, and Backup. Click *Updates* on the left side of the dialog to display the *Updates* options on the right side of the dialog. Use the *Updates* to control the update preferences for **Grapher**.



*Use the***Options***dialog to set***Grapher***preferences.*

Automatically Check For Updates

An update is a free newer version of the program. Updates include corrections to problems that have been found. Check the *Automatically check for updates* box to allow Golden Software to check for program updates (e.g. Grapher 15.0 to Grapher 15.1) according to the user defined time interval. Additionally, if a crash occurs while the program is running, a check for update will occur the next time the program is started.

Adjust the update preferences at any time. Allowing automatic checking for updates allow you to have the most recent version of the program. It is highly advised that you have this option checked. No information is transferred to Golden Software with this option.

When this option is unchecked, updates can be checked for manually. Click the **File | Online | Check for Update** command to manually check for any updates.

Automatically Check For Announcements

An announcement is a message from Golden Software regarding changes made to Grapher or company announcements. This could include information about a new product release, tips for use of Golden Software programs, special offers, or an update to the program. It is highly recommend that you have this option checked. No information is transferred to Golden Software with this option.

Update Interval (Days)

Specify the update time interval in days by entering a number in the *Update interval (days)* box or using the up and down arrows to the right of the box. **Grapher** will automatically check for updates after the specified interval of time has passed if the *Automatically check for updates* option is checked. To change the *Update interval (days)*, highlight the existing value and type a new value or click the to increase or decrease the time interval.

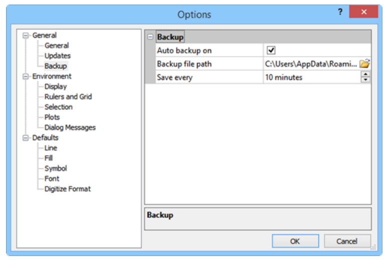
Check Now

Click the *Check Now*button next to the*Check for updates*command to check for program updates. Before using this command, make sure your computer is connected to the Internet. Follow the directions in the **Internet Update** dialog to complete the update if an update is available. In addition to this location, program updates can be checked at any time with the File | Online | Check For Update command.

Options - Backup

You can set defaults such as file open/save paths, page units, undo levels, through the File | Options command. In the **Options** dialog, click the button next to *General* to expand the *General* section to access these items. Changes made in the **Options** dialog affect all subsequent documents. Existing documents and settings are not changed.

The **General** section has the following sub-sections: [General](), [Updates](), and **Backup**. Click *Backup* on the left side of the dialog to display the *Backup* options on the right side of the dialog. Use the *Backup* options to control the backup preferences.



*Use the***Options***dialog to set***Grapher***preferences.*

Auto Backup On

Check the *Auto backup on* box to have **Grapher** automatically save a backup of every open, modified document at regular intervals. Backups are named <file name>.gbk.<ext>, e.g., sample.gbk.grf.

Backup File Path

Set the file path where backup files are saved in the *Backup file path* box.

Click the button to open a dialog and select a directory on the computer.

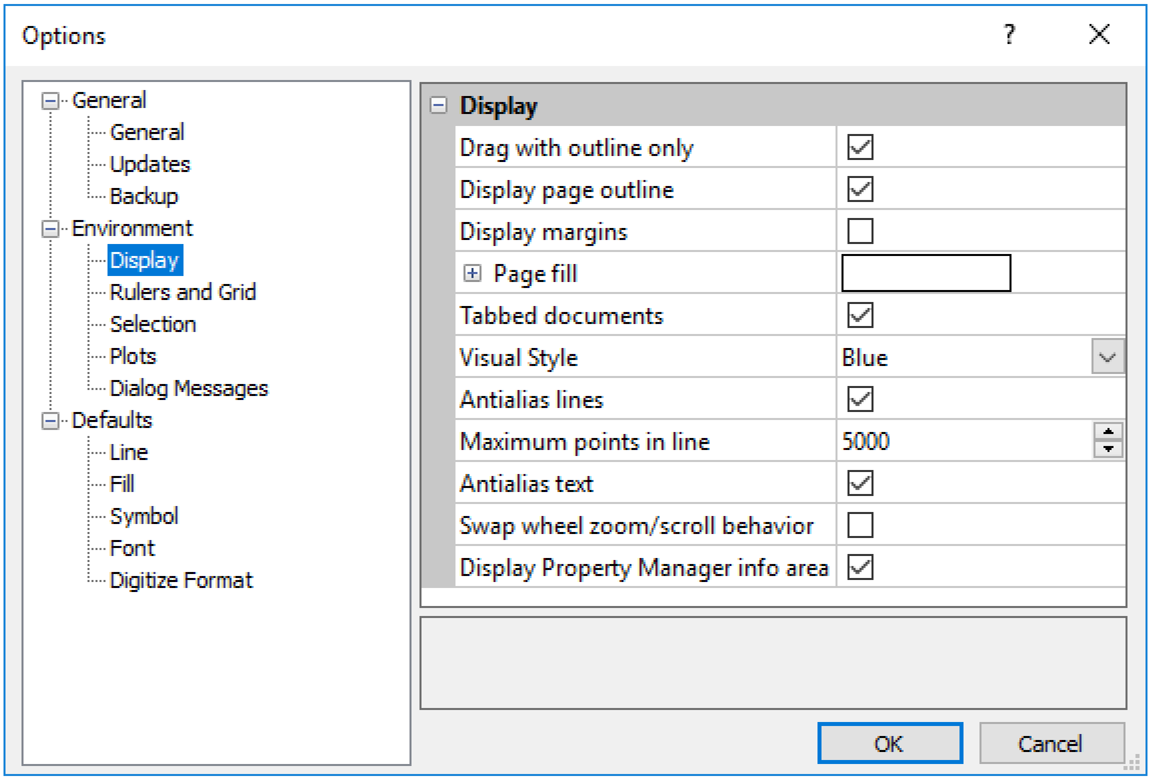
Save Every

Change the save interval by entering a new value or scrolling to a new value next to *Save every*. Documents may be saved at intervals between 1 and 120 minutes. The default save interval is 10 minutes.

Options - Display

You can set defaults such as file open/save paths, page units, undo levels through the File | Options command. In the **Options** dialog, click the button next to *Environment* to expand the *Environment* section to access these items. Changes made in the **Options** dialog affect all subsequent documents. Existing documents and settings are not changed.

The **Environment** section has the following sub-sections: **Display**, Rulers and Grid, Selection, Plots, and Dialog Messages. Click *Display* on the left side of the dialog to display the *Display* options on the right side of the dialog. Use the *Display* options to control various display settings in **Grapher**.



Use the ***Options*** *dialog to set* ***Grapher*** *preferences.*

Drag With Outline Only

Check *Drag with outline only* to show a dashed outline of the [selected object](#) when it is moved while retaining the original location of the object. Uncheck this option to show the entire object move without retaining the original location of the object.

Display Page Outline

Use the *Display page outline* option to display or hide the page outline in the plot window. Check this option to display the page outline. Uncheck this option to hide the page outline. The page size is set through the [File | Page Setup](#) command.

Display Margins

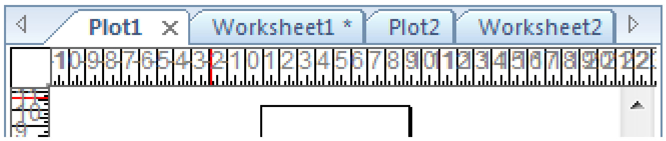
Click *Display margins* to show the margin settings on the page as dashed lines. Uncheck this option to hide the page margins. Margins are set through the [File | Page Setup](#) command.

Page Fill

Use *Page fill* to set the background fill. The fill is not intended to be printed or exported, but is only for use in the **Grapher** window. Click the ⊞ button to the left of *Page fill* to expand this section and select fill properties for the *Page fill*.

Tabbed Documents

Check the box next to *Tabbed documents* to display each plot and worksheet window as a series of tabs. When viewing in tabbed document mode, the tabs may be dragged to reorder them. The left/right arrow buttons at the right of the tabs are used to scroll the tabs should there be more tabs than can fit along the top of the window.



Plot 1, Worksheet1, Plot2, and Worksheet2 are tabbed.
The left and right arrows are used to scroll.

When a document contains unsaved changes, an asterisk appears next to its tabbed name. The asterisk (*) disappears once the unsaved changes have been saved.

Visual Style

Change *Visual Style* option to change the visual look of **Grapher**. Select the *Black, Blue,* or *Silver* theme. The default is the *Blue* theme.

Antialias Lines

Check the *Antialias lines* option to use antialiasing to draw lines to produce smoother looking graphic objects.

Maximum Points in Line

Lines are antialiased when the *Antialias lines*option is checked and when the line does not contain more than the number of points specified in the*Maximum points in line*. Increasing this value slows the redraw of the graph, but will make lines on the screen appear smoother. Setting this value to -1 will result in all lines, regardless of how many points are in the line, being antialiased.

Antialias Text

Check the *Antialias text* option to use antialiasing to draw text to produce smoother looking text and symbol objects.

Swap Wheel Zoom/Scroll Behavior

The default behavior is for the wheel on a wheel mouse to control zoom in and zoom out. Check the *Swap wheel zoom/scroll behavior* for the wheel on a wheel mouse to control the page scroll.

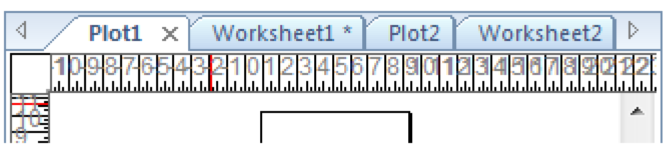
Display Info Area

Check the *Display Property Manager info area* box to display a small box in the **Property Manager** that shows a short description of the selected option. The **Property Manager** information area is displayed by default.

Tabbed Documents

In a plot window, click the **File | Options** command. In the **Options**dialog, on the left side, click on *Display*. On the right side, check the *Tabbed documents* command to display plot, worksheet, and grid windows as tabbed documents rather than the traditional multiple document interface.

When viewing in tabbed document mode, the tabs may be dragged to reorder them. The left/right arrow buttons at the right of the tabs are used to scroll the tabs should there be more tabs than can fit along the top of the window.



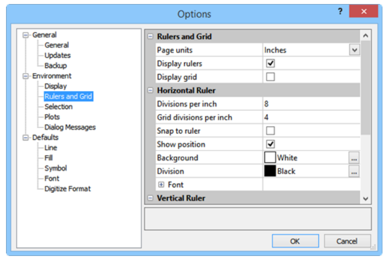
Plot 1, Worksheet1, Plot2, and Worksheet2 are tabbed.
The left and right arrows are used to scroll.

When a document contains unsaved changes, an asterisk appears next to its tabbed name. The asterisk (*) disappears once the unsaved changes have been saved.

Options - Rulers and Grid

You can set defaults such as file open/save paths, page units, undo levels through the File | Options command. In the **Options** dialog, click the button next to *Environment* to expand the *Environment* section to access these items. Changes made in the **Options** dialog affect all subsequent documents. Existing documents and settings are not changed.

The **Environment** section has the following sub-sections: Display, **Rulers and Grid**, Selection, Plots, and Dialog Messages. Click *Rulers and* *grid* on the left side of the dialog to display the *Rulers and Grid* settings on the right side of the dialog. Use the *Rulers and Grid* options to control the display of horizontal rulers, vertical rulers, and the page grid



Use the **Options** *dialog to set* **Grapher** *preferences.*

Page Units

Set the *Page units* to *Inches* or *Centimeters*. The page units are used in the status bar display and in many **Property Manager** options.

Display Rulers

Check the *Display rulers* box to turn on the display of the horizontal and vertical rulers. Uncheck the box to turn off the display of rulers.

Display Grid

Check the *Display grid* box to turn the drawing grid on. Uncheck the box to turn off the display of the drawing grid.

Horizontal and Vertical Rulers

Click the ⊞ button to the left of the *Horizontal Ruler* or *Vertical Ruler* sections to expand the options for the horizontal or vertical ruler.

- Enter a value next to *Divisions per inch* (or cm) to set the number of divisions per page unit on the ruler.
- Enter a value next to *Grid divisions per inch* (or cm) to set the number of divisions per page unit on the grid.
- Check the *Snap to ruler* box to instruct the mouse to snap to the ruler divisions as objects are drawn or moved.
- Check the *Show position* box to show the mouse position as red lines on the rulers.
- The ruler background color can be set by choosing a color from the *Background* color palette. Click on the color to open the palette and then click on a new color. Click the ... to open the **Colors** dialog where you can set a custom color.
- The ruler tick color can be set by choosing a color from the

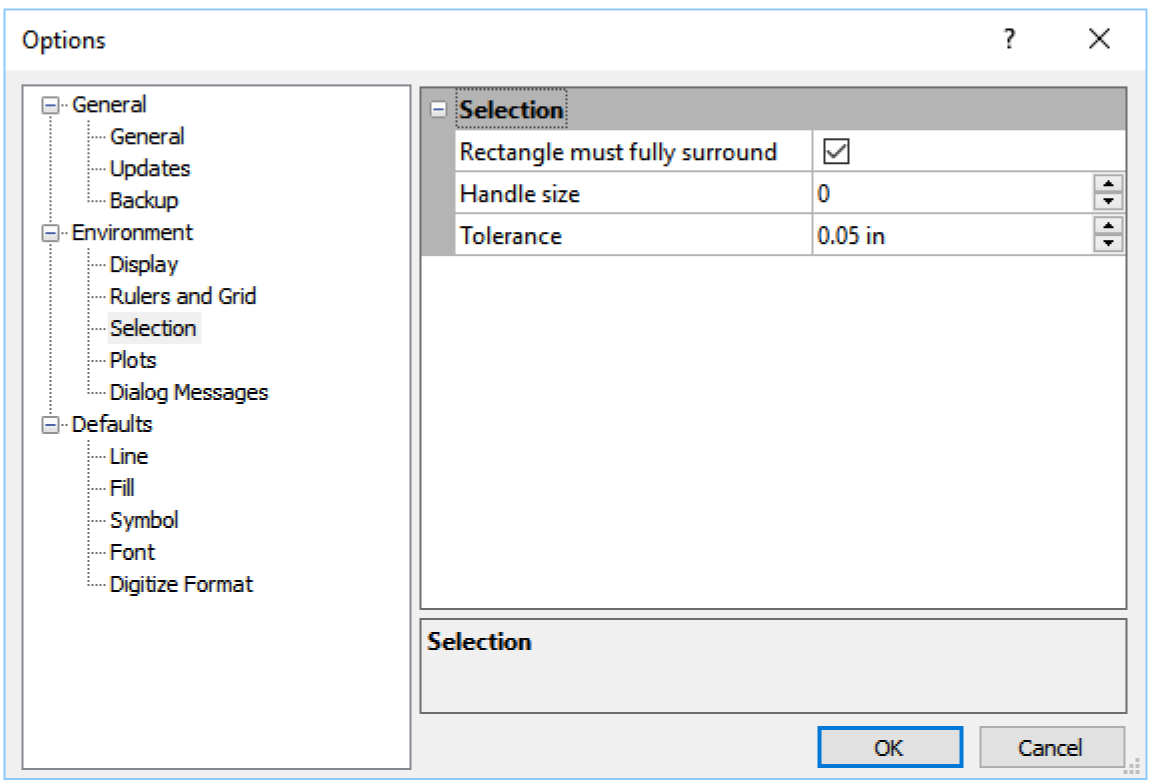
Division color palette. Click on the color button to open the palette and then click on a new color. Click the to open the **Colors** dialog where you can set a custom color.

- Click the next to *Font* to open the font properties section to change the font, size, color, and other properties used to display the page unit numbers in the rulers.

Options - Selection

You can set defaults such as file open/save paths, page units, undo levels through the File | Options command. In the **Options** dialog, click the button next to *Environment* to expand the *Environment* section to access these items. Changes made in the **Options** dialog affect all subsequent documents. Existing documents and settings are not changed.

The **Environment** section has the following sub-sections: Display, Rulers and Grid, **Selection**, Plots, and Dialog Messages. Click *Selection* on the left side of the dialog to display the *Selection* options on the right side of the dialog. Use the *Selection* options to control how objects are selected in the plot window.



*Use the **Options** dialog to set **Grapher** preferences.*

Rectangle Must Fully Surround

The *Rectangle must fully surround* option controls how the Block Select command functions. If the box is checked, the block select rectangle must be drawn completely around the object to select it. If any portion of the object extends beyond the block select rectangle, the object is not selected. If this option is unchecked, the block select rectangle only needs to partially intersect an object to select it.

Handle Size

The *Handle size* box controls the width and height of the selection handles that appear around selected objects. This value must be between 0 and 50. The larger the *Handle size*value, the larger the handles will be displayed.

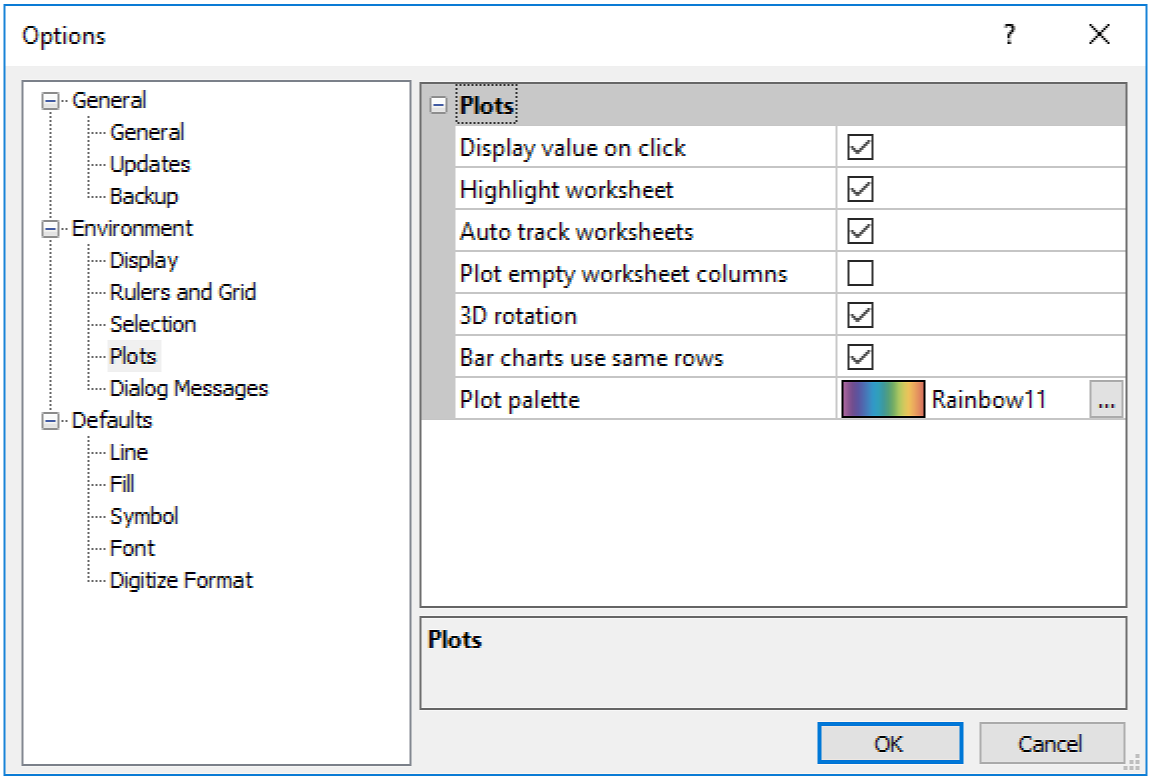
Tolerance

The *Tolerance* box controls the distance between the pointer and the object when left-clicking to select an object. When the aperture size is zero, the pointer must be directly on the object to select it. The aperture setting range is from 0.0 inches to 0.50 inches. The aperture size does not affect the size of the bounding box; it controls the distance the pointer can be from the object to select it.

Options - Plots

You can set defaults such as file open/save paths, page units, undo levels through the File | Options command. In the **Options** dialog, click the ⊞ button next to *Environment* to expand the *Environment* section to access these items. Changes made in the **Options** dialog affect all subsequent documents. Existing documents and settings are not changed.

The **Environment** section has the following sub-sections: Display, Rulers and Grid, Selection, **Plots**, and Dialog Messages. Click **Plots** on the left side of the dialog to display the *Plots* options on the right side of the dialog. Use the *Plots* options to show plot values using the mouse, to track worksheet values when clicking on graphs, and to set the 3D rotation mode.



Use the **Options** *dialog to set* **Grapher** *preferences.*

Display Value On Click

If *Display value on click* is checked, the data point value is displayed in the [status bar](#) when clicking on a data point. To display the value, select the plot, then click and hold the left mouse button on a data point. The value of the point is displayed in the status bar as long as the mouse button is held down and the mouse is not moved. Note that only points obtained from the worksheet are displayed. Click the [Graph Tools | Digitize | Digitize](#) or [Graph Tools | Digitize | Digitize Fixed](#) commands to obtain the values of intermediate points on the graph. This feature is available with line/scatter, step, bubble, function, ternary, bar chart, floating bar, histogram, and polar plots.

Highlight Worksheet

If *Highlight worksheet* is checked, the worksheet cells used by a data point are selected when a data point is clicked. This feature is available with line/scatter, class scatter, step, bar chart, floating bar chart, polar, polar class scatter, polar bar chart, bubble, ternary, vector, 3D ribbon/wall, 3D step, 3D bar chart, 3D floating bar chart, 3D XYZ line/scatter, 3D XYZ class scatter, and 3D XYZ bubble plots.

Auto Track Worksheets

If the *Auto track worksheets* command is checked, changes made in the **Grapher** worksheet are automatically updated on the graph. If *Auto track worksheets* is unchecked, changes made to the worksheet do not show on the graph. This command only applies to changes made in the **Grapher**worksheet. If changes are made in a program other than **Grapher**, use the File | Reload Data command.

Plot Empty Worksheet Columns

Select the *Plot empty worksheet columns* option to display all worksheet columns between the first and last column with data regardless if each column includes data. The empty columns can be selected for use in a plot in the *Data* section of the Property Manager**Plot** page for the various plots. However, no plot is displayed if an empty column is selected for one of the *Data* properties. This option can be useful when creating a template if your data file doesn't always include all the data, but data is consistently located in the same column when available.

3D Rotation

The *3D rotation* option provides 3D virtual rotation with the mouse. When the *3D rotation* option is checked, the Free Rotate command rotates 3D graphs by rotating the graph in relation to the plot window point of view in the direction the mouse is dragged. When the *3D rotation* option cleared, the **Free Rotate** command rotates 3D graphs about the Y axis when the mouse is dragged left or right and rotates 3D graphs about the X axis when the mouse is dragged up or down..

Bar Charts Use Same Rows

If the *Bar charts use same rows* option is checked, grouped bar charts will use the same worksheet rows for all grouped bar charts. When one bar chart changes the rows, all bar charts in the group are changed. When unchecked, each bar chart is able to set different values for the worksheet rows.

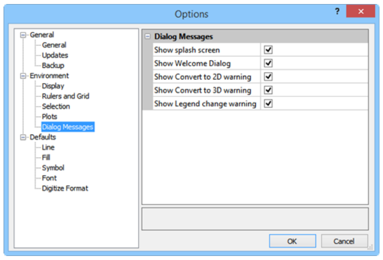
Plot Palette

The *Plot palette* is the color gradient that controls the color of new plot line, fill, and/or symbol colors when adding new plots via the *Create* button on the **Plot** page in the Property Manager. New plots will sample their colors from the *Plot palette* color gradient from left to right. For example, the first line plot will use the default color, the second plot will be gray, and the subsequent plots will vary along the rainbow from violet to red with the default *Plot palette* color gradient.

Options - Dialog Messages

You can set defaults such as file open/save paths, page units, undo levels through the File | Options command. In the **Options** dialog, click the ⊞ button next to *Environment* to expand the *Environment* section to access these items. Changes made in the **Options** dialog affect all subsequent documents. Existing documents and settings are not changed.

The **Environment** section has the following sub-sections: Display, Rulers and Grid, Selection, Plots, and **Dialog Messages**. Click *Dialog Messages* on the left side of the dialog to display the *Dialog Messages* options on the right side of the dialog. Use the *Dialog Messages* options to turn on the display of the splash screen, welcome dialog, and various warning messages.



*Use the **Options** dialog to set **Grapher** preferences.*

Show Splash Screen

Check the *Show splash screen* option to display the splash screen when **Grapher** opens. When unchecked, the splash screen does not appear.

Show Welcome Dialog

Check the *Show Welcome Dialog* option to display the welcome dialog when **Grapher** opens. When unchecked, the welcome dialog does not appear.

Show Convert to 2D Warning

Check the *Show Convert to 2D warning* option to display the warning message when converting a 3D graph to a 2D graph. The warning indicates if any information will be lost after the conversion. When unchecked, the warning does not appear.

Show Convert to 3D Warning

Check the *Show Convert to 3D warning* option to display the warning message when converting a 2D graph to a 3D graph. The warning indicates if any information will be lost after the conversion. When unchecked, the warning does not appear.

Show Legend Change Warning

Check the *Show Legend change warning* option to display the warning message when changing all legend entries at once. The warning indicates if any information will be lost after the change. When unchecked, the warning does not appear.

Options - Defaults

You can set defaults such as file open/save paths, page units, undo levels, through the File | Options command. In the **Options** dialog, click the ⊞ button next to *Defaults* to expand the *Defaults* section to access these items. Changes made in the **Options** dialog affect all subsequent documents. Existing documents and settings are not changed.

Default settings for specific object types, such as line/scatter plots, rectangles, or legends can be set with the File | Defaults command.

The **Defaults** section has the following sub-sections: **Line**, **Fill**, **Symbol**, **Font**, and **Digitize Format**.

Line

Click *Line* on the left side of the dialog to display the *Line Properties* on the right side of the dialog. Use the *Line Properties* to set the default Line Properties.

Fill

Click *Fill* on the left side of the dialog to display the *Fill Properties* on the right side of the dialog. Use the *Fill Properties* to set the default Fill Properties.

Symbol

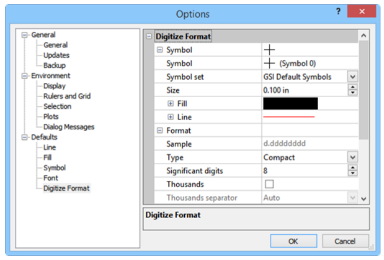
Click *Symbol* on the left side of the dialog to display the *Symbol Properties* on the right side of the dialog. Use the *Symbol Properties* to set the default Symbol Properties.

Font

Click *Font* on the left side of the dialog to display the *Font Properties* on the right side of the dialog. Use the *FontProperties* to set the default Font Properties.

Digitize Format

Click *Digitize Format* on the left side of the dialog to display the *Digitize Format* options on the right side of the dialog. Use *Digitize Format* options to set the symbol properties and numeric and label format for digitizing.



*Use the***Options***dialog to set***Grapher***preferences.*

Changing the Digitizing Symbol

To change the digitizing symbol:

1. Click the **File | Options** command.
2. In the **Options** dialog, click on *Digitize Format* on the left side of the dialog.
3. On the right side of the dialog, click the ⊞ next to *Symbol*.
4. Select the *Symbol* by clicking on the existing symbol and selecting the desired symbol from the list.
5. Change the symbol size, color, or other symbol properties if desired.
6. Click *OK* to return to the plot window.
7. Click on the plot and click the **Graphs | Digitizing | Digitize** command.
8. Click on the screen and the new symbol will be displayed.

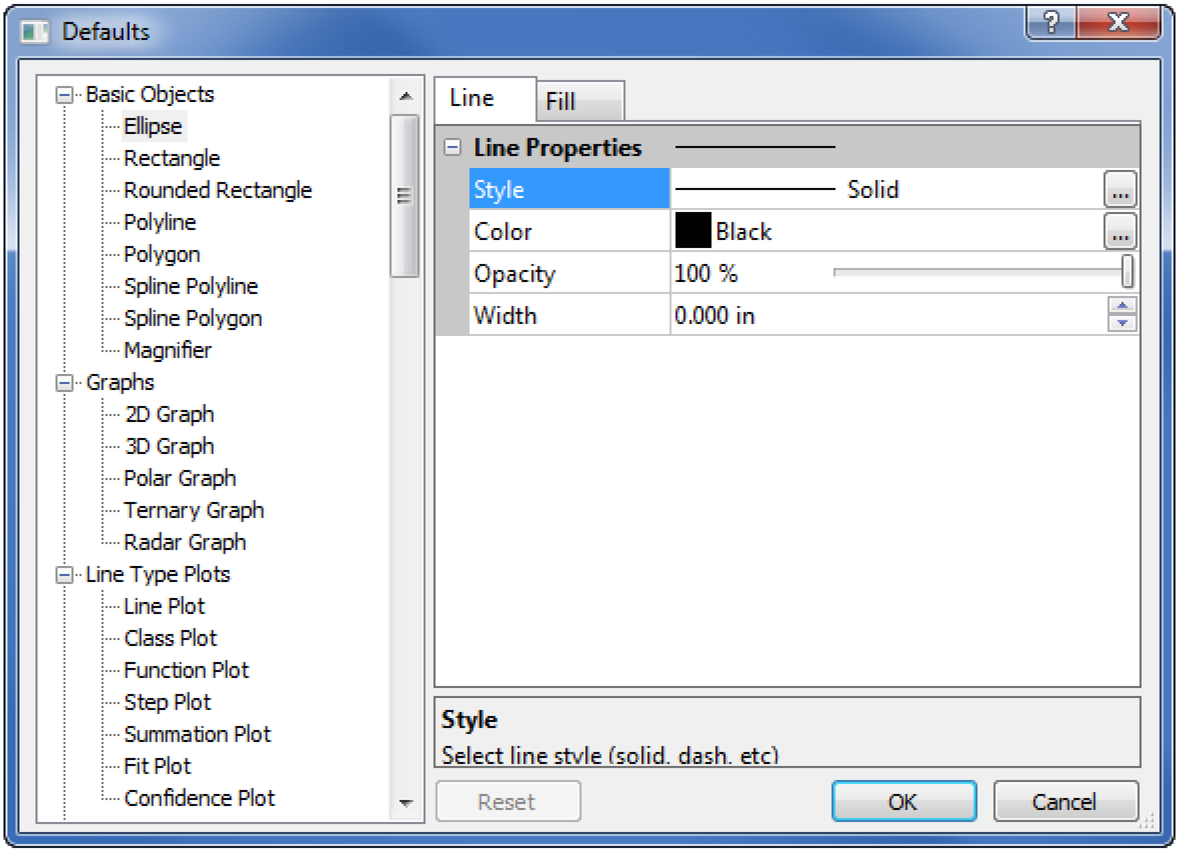
File | Defaults

Click the **File | Defaults** command to change the default properties for basic objects, graphs, plots, axes, and legends. Changing these default properties makes the change only for the selected object type. Once the defaults have been changed, all new objects created from the ribbon commands will have those attributes. For example, if you change the line color to red for an ellipse object, all future ellipse objects will have the red line color by default. Existing objects will not be changed. However, if you create new plots from the *Create* command in the **Plot** page of the Property Manager, subsequent plots will be colored by the *Plot palette* option.

Default settings for graphing objects can also be set through template graphs. **Grapher** program options can be controlled with the File | Options command.

Defaults Dialog

Use the **File | Defaults** command to open the **Defaults** dialog.



*Use the **Defaults** dialog to specify **Grapher** default options.*

Expanding Options

Left-click the button to the left of an option to expand the detailed options.

Condensing Options

Left-click the button to the left of an option to condense the detailed options.

Left Side - Default Categories

The default settings for *Basic Objects*, *Graphs*, *Line Type Plots*, *Bar Type Plots*, *Polar Type Plots*, *3D XYY Plots*, *3D XYZ Plots*, *Maps*, *Other Plots*, *Axes*, *Legend*, *Wind Chart Legend*, and *Class Scatter Plot Legend* can be accessed on the left side of the dialog. Left-click on an item to display the current settings on the right side of the dialog.

- *Basic Objects* include *Ellipse, Rectangle, Rounded Rectangle, Polyline, Polygon, Spline Polyline, Spline Polygon,* and *Magnifier.*
- *Graphs* include *2D Graph, 3D Graph, Polar Graph, Ternary Graph,* and *Radar Graph.*
- Line Type Plots include *Line Plot, Class Scatter Plot, Function Plot, Step Plot, Math Plot, Fit Plot,* and *Confidence Plot.*
- Bar Type Plots include *Bar Chart, Floating Bar,* and *Histogram.*
- Polar Type Plots include *Polar Line Plot, Polar Vector Plot, Polar Class Scatter Plot, Polar Bar Chart, Polar Function Plot, Rose Diagram,* and *Polar Wind Chart.*
- 3D Plots include *3DBar Chart, 3D Floating Bar, 3D Function Plot, 3D Histogram, 3D Ribbon Plot,* and *3DStep Plot.*
- XYZ Plots include *XYZ Line Plot, XYZ Class Scatter Plot, XYZ Bar Chart, XYZ Floating Bar Chart,XYZ Bubble Plot* and *XYZ Vector Plot.*
- Maps include *Contour XY Data Map, Contour XZ Data Map, Contour XY Grid Map, Contour XZ Grid Map, Contour XY Function Map, Contour XZ Function Map, Surface Data Map, Surface Grid Map, Surface Function Map, Color Scale,* and *Surface Color Scale.*
- Other Plots include *Box-Whisker Plot, Q-Q Plot, Bubble Plot, Hi-Low-Close Plot, Pie Chart, 3D Pie Chart, Doughnut Plot, 3D Doughnut Plot, Stiff Plot, Ternary Plot, Ternary Class Scatter Plot, Vector Plot,* and *Radar Plot.*
- Axes include *X Axis, Y Axis, 3D X Axis, 3D Y Axis, 3D Z Axis, Polar Radius Axis, Polar Angle Axis, Ternary X Axis, Ternary Y Axis, Ternary Z Axis, Box Plot Axis, Stiff Plot Axis,* and *Radar Graph Axis.*
- Legendcontains options for default legend properties. An empty string can be set for the default legend title. When set to no text, no title is displayed when a legend is created. The default legend title is *Legend*. You can set options for linking legend titles, entries, legend font properties, etc. To automatically use the graph name for the legend title, set the *Legend* title default text to <<*Graph Name*>>. This will display the linked graph name as the legend title for most legends. This will display <<Graph Name>> as the default title for multi-graph legends, as these are not linked to a single graph.
- Polar Wind Chart Legendcontains options for default wind chart legend properties. An empty string can be set for the default graph title. When set to no text, no title is displayed when a legend is created. The default legend title is *Legend*. You can set options for linking legend titles, entries, legend font properties, etc. To automatically use the graph name for the legend title, set the *Legend* title default text to <<*Graph Name*>>. This will display the linked graph name as the legend title for wind chart legends.
- Class Scatter Plot Legendcontains options for default class plot legend properties. An empty string can be set for the default graph title. When set to no text, no title is displayed when a legend is

created. The default legend title is *Legend*. You can set options for linking legend titles, entries, legend font properties, etc. To automatically use the graph name for the legend title, set the *Legend* title default text to <<*Graph Name*>>. This will display the linked graph name as the legend title for class plot legends.

Right Side - Default Properties

The current settings for the selected item are displayed on the right side of the dialog. The appropriate tabs are displayed (i.e. **Line** or **Fill**) with the appropriate options for the selected object type. Make any appropriate changes and click the *OK* button.

Reset

Select a default category and click the *Reset*button to restore an object to its base default settings.

Customizing Commands

Click the **File | Customize Ribbon** command to customize the Quick Access Toolbar, Ribbon, and keyboard shortcuts.

Customizing the Quick Access Toolbar

The Quick Access Toolbar is a customizable toolbar. One method that can be used to add commands to the Quick Access Toolbar is to right-click on the command in the ribbon and click **Add to Quick Access Toolbar**. The command is automatically added to the end of the Quick Access Toolbar. To customize the commands and their locations on the Quick Access Toolbar, right-click the ribbon and click **Customize Quick Access Toolbar**. In the **Customize** dialog,

1. To add a command, select the command from the list on the left that you want to add. Click the *Add>>* button and the command is added to the list on the right.
2. To add a separator between commands, set the *Choose commands from* to *Home* on the left side of the dialog. Select <*Separator*> and click *Add>>*. Move the separator to the desired position.
3. To delete a command, select the command from the list on the right. Click the *<<Remove* button and the command is removed from the list on the right.
4. To rearrange commands or move separators, click on the command or separator name from the list on the right that you want to move. Click the up and down arrow buttons on the far right to move the command up or down the list. Commands are shown in the exact

order that they are displayed in the Quick Access Toolbar.

5. To reset the Quick Access Toolbar to the default display, click the *Reset* button below the list on the right side of the dialog.
6. Click OK and all changes are made.

Note: to add individual plot types to the Quick Access Toolbar, select *Home* from the *Choose commands from* list. Next, select the desired plot type, such as *3D Vertical Bar Chart*, from the commands list on the left. Click *Add>>* and the plot type is added with an icon to the list on the right. Click *OK* and the plot type is displayed in the Quick Access Toolbar.

Customizing the Ribbon

The ribbon is customizable in **Grapher**. To customize the commands in the ribbon, right-click the ribbon and select **Customize the Ribbon**. In the dialog, you can add new tabs, add groups, add commands to custom group, hide existing tabs or groups, and rearrange the tabs into an order that better fits your needs.

Tab options:

1. To add a custom tab, set the *Customize the Ribbon* section to *All Tabs*. Click in the list on the right side of the dialog where the custom tab should be located and click the *New Tab* button.
2. To delete custom tab, right-click on the tab name in the list on the right side of the dialog and select **Delete**.
3. To rename a default or custom tab, click on the tab name in the list on the right side of the dialog. Click the *Rename* button. Type the new name and press OK to make the change.
4. To hide a default or custom tab, uncheck the box next to the tab name on the right side of the dialog. Only checked tabs will be displayed.
5. To change the order of default or custom tabs, click on the tab name that should be moved in the list on the right side of the dialog. Click the up and down arrow buttons on the far right side of the dialog to move the selected tab up or down. Default tabs must remain in their major group.

Group options:

1. To add a custom group to a default or custom tab, click on the ⊞ next to the tab name. Click in the list of group names where the new group should be located and click the *New Group* button.
2. To delete a default or custom group on any tab, right-click on the group name in the list on the right side of the dialog and select

Delete.

3. To rename a default or custom group on any tab, click on the group name in the list on the right side of the dialog. Click the *Rename* button. Type the new name and click OK to make the change.
4. To change the order of default or custom groups on any tab, click on the group name that should be moved in the list on the right side of the dialog. Click the up and down arrow buttons on the far right side of the dialog to move the selected group up or down in the list.
5. To replace a default group with a custom group, right-click on the default group name and select **Delete**. Click the *New Group* button. Add the desired commands to the new group that you want displayed. Rename the new group, if desired.

Command options:

Commands can only be added to or deleted from custom groups. Commands can only be rearranged or renamed in custom groups. If commands in default groups are desired to be edited, the default group should be deleted and a new custom group should be created with the same commands.

1. To add a command to a custom group, set the *choose commands from* list to *All Tabs* so that all commands are listed on the left side of the dialog. Select the desired command that should be added. On the right side of the dialog, click the ⊞ next to the custom group name. Click on the desired position in the list of commands. If no commands exist in the group yet, click on the group name. Click the *Add>>* button and the command is added to the custom group.
2. To delete a command from a custom group, right-click on the command name in the list on the right side of the dialog and select *Delete*. Only commands from custom groups can be deleted.
3. To rename a command in a custom group, click on the command name in the list on the right side of the dialog. Click the *Rename* button. Type the new name and click OK to make the change. Only commands in custom groups can be renamed.
4. To change the order of commands in a custom group, click on the command name that should be moved in the list on the right side of the dialog. Click the up and down arrow buttons on the far right side of the dialog to move the selected command up or down in the list.

Customizing the Keyboard Shortcuts

Keyboard shortcuts can be changed by right-clicking on the ribbon and selecting **Customize the Ribbon**.

1. In the dialog, click the *Customize* button next to *Keyboard shortcuts*.

2. On the left side of the **Customize Keyboard** dialog, select the ribbon tab name in the *Categories* list where the desired command is located.
3. On the right side of the dialog, click on the command name in the *Commands* list.
4. Click in the *Press new shortcut key* box and press and hold the keys that should be used for the command. For instance, you might press and hold the CTRL, SHIFT, and H keys on the keyboard. The key names CTRL+SHIFT+H will be listed in the *Press new shortcut key* box. If no other command uses the key combination, the *Assigned to* section lists [Unassigned].
5. When the keys are unassigned, click the *Assign* button at the bottom of the dialog to assign the key combination to the selected command.

If the key combination is currently assigned to another command, the command will be listed in the *Assigned to* section. If a key combination is currently assigned to another command, select the currently assigned command name. Click on the *Current Keys* combination that you want to reassign and click the *Remove* button at the bottom of the dialog. Click back on the original command. Click in the *Press new shortcut key* box and press the keys on the keyboard. Click the *Assign* button to assign the key combination to the new command.

Click *Close* to make the new commands effective. Click *Reset All* to reset all customizations to the defaults.

Sharing Customizations Between Computers

All of the **Grapher** Quick Access Toolbar, ribbon, and keyboard commands are stored in the registry. The registry key can be copied and pasted onto other computers to easily share customizations. Be very careful when editing the registry! A small mistake can cause the program or computer to become unresponsive.

1. Make any customizations to the ribbon, quick access toolbar, and any keyboard commands you desire.
2. When all customizations have been made, close **Grapher**.
3. Open the registry. In Windows Vista and 7, you can do this by clicking the Windows Start button and typing *regedit* into the *Start Search* box.
4. Go to the *HKEY_CURRENT_USER\Software\Golden Software\Grapher\13\BCGSettings\BCGRibbonBar-59398* key.
5. Click the **File | Export** command.
6. Type a name, such as *My Customizations*, and make sure that the

Selected range is set to the *Selected branch*.

7. Click *Save*.
8. Locate the .REG file on your computer and copy it to a CD, USB drive, or network share location.
9. On another computer, close **Grapher**.
10. Paste the .REG file in a place where it is easily found on the new computer.
11. Double-click on the .REG file.
12. Click *Yes* if you are prompted if you want to change the computer.
13. Open **Grapher**. The customizations have been applied to the new machine.

Scripter

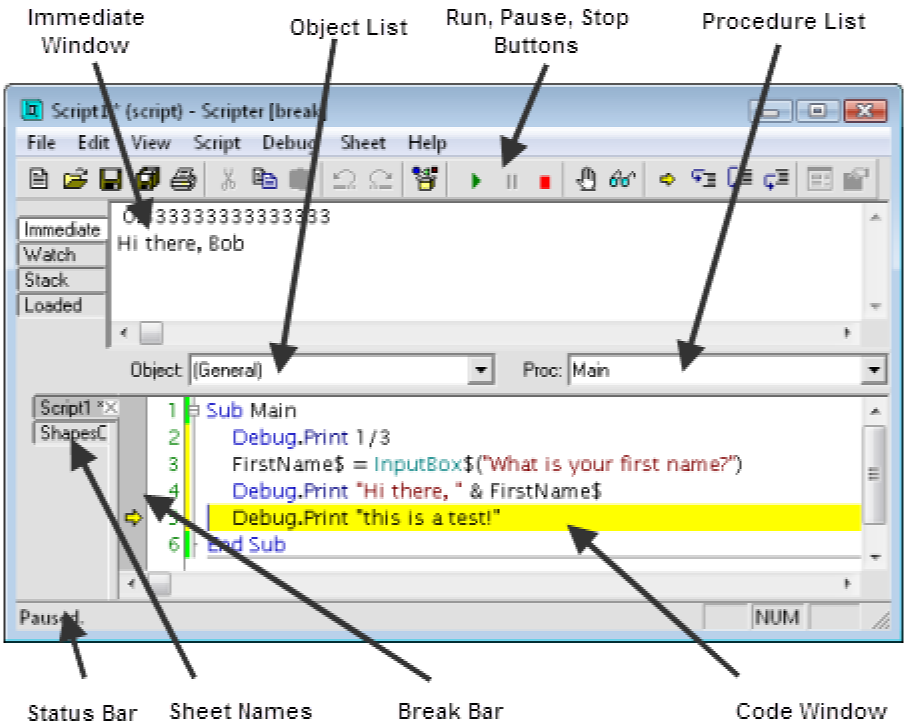
Golden Software's **Scripter** is a program for developing and running scripts. A script is a text file containing a series of instructions carried out when the script is run. Instructions are written in a Visual BASIC-like programming language. **Scripter** offers many features to help you write, edit, and debug scripts. Its features include language syntax coloring, a list of the procedures defined in the script, an object browser for examining procedures available in external objects, a visual dialog editor, break points, single-step execution (including options to step over and to step out of procedures), a watch window for displaying the values of script variables, and more.

Grapher operations can be controlled through automation scripts. You can do almost everything with a script that you can do manually with the mouse or from the keyboard. Scripts are used to automate repetitive tasks or consolidate a complicated sequence of steps. Since **Grapher** exposes its services through automation, you can use any programming tool that accesses automation objects, such as Visual BASIC, Windows Scripting Host, and many of the Microsoft Office applications.

To open Scripter, click the Windows Start button and navigate to **Programs | Golden Software Grapher 15 | Scripter**. If **Scripter** is not present, the installation of **Scripter** may have been skipped when **Grapher** was installed. See the README.RTF file in the **Grapher** installation directory for information about the installation process.

Scripter Windows

When **Scripter** is first started, you are presented with a text editor window containing the lines Sub Main, followed by a blank line, and then End Sub. This is the code editor window where script instructions are typed and where the contents of script files are displayed.



*This **Scripter** application window is shown while execution of a script is paused.*

Code Window

The code window acts as a text editor, similar to the Windows Notepad program, with a few enhancements to facilitate script writing:

- After you press the ENTER key, tabs or spaces are automatically inserted at the beginning of the next line to maintain the same indentation level as the previous line.
- Key words and symbols of the BASIC language are displayed in different colors. You can use the **View | Colors** command to modify the colors used to display the various elements of the programming language.
- A light horizontal divider line is automatically drawn between sections of your script. The divider lines help you to locate the start of subroutine and function definitions.

Object and Procedure Lists

Above the code editor window is a bar containing the *Object* and *Proc* (procedure) lists. Selecting items from these lists moves the various sections of your script file into view. The object and procedure lists are useful when your script file becomes large.

Immediate Window

Above the object and procedure lists, you may see a blank window area with a tab on top that reads **Immediate**. If this window is not visible, select the **View | Always Split** command to make it appear. The immediate window is used to execute one-line instructions immediately. When you type an instruction into this window and press the ENTER key, **Scripter** carries out the instruction.

In addition to being a scratch area for evaluating language statements, the immediate window shows debugging information. The output from the `Debug.Print` statement and the value of variables selected with the **Debug | Quick Watch** command are printed in the immediate window. While a script program is running, **Watch**, **Stack**, and **Loaded** tabs are added at the top of the immediate window area. Click these tabs for information that may be useful for debugging. See Debugging Scripts for more information on the immediate, watch, stack, and loaded windows.

Sheet Tabs

Along the left edge of the code window are code sheet tabs. When you select either the **File | New** command or the **File | Open** command, **Scripter** creates a new code sheet and inserts a new sheet tab. Each tab corresponds to one of the code sheets. Clicking once on a tab makes that sheet the current sheet. Double-clicking a tab closes the sheet.

Break Bar

Between the sheet tabs and the code window is an area called the "break bar." When a script is paused, a yellow arrow in the break bar shows which line is next to execute. The break bar also shows which lines have break points. Set a break point by clicking on the break bar. A red dot appears in the break bar, and the adjacent line in the code window is highlighted. When a line marked as a break point is about to be executed, **Scripter** pauses program execution. To clear a break point, click on the red dot in the break bar. See Debugging Scripts for more information on break points.

Status Bar

A status bar along the bottom of the **Scripter** window shows information about the current state of the program. The **View | Status Bar** command hides or reveals the status bar. Before running a script, make sure that the status bar is visible because messages about typographical and syntax errors are displayed in the status bar.

Working with Scripts

You can create new scripts, edit existing scripts, save scripts, and close scripts in **Scripter**.

New Scripts

To create a new script, select the **File | New** command. A blank script sheet is created. You can start typing script instructions into this sheet. If you edit more than one sheet at a time, click the sheet tabs to switch between them or select the **Sheet | 1**, **Sheet | 2**, etc. menu commands. You can edit up to nine code sheets at the same time.

New Modules

To create a custom ActiveX object, select the **File | New Module**command, and choose either **Object Module** or **Class Module** (choosing **Code Module** is the same as the **File | New** command).

Existing Scripts and Modules

To open an existing script, select the **File | Open** command. To open a script you opened recently, click its name at the bottom of the **File** menu. To open other modules used by your script, select the **Sheet | Open Uses** command.

Saving Scripts

Once a script is complete, you can save the script by using the **File | Save** or **File | Save As** commands. If a script has not been changed since the last save, the **Save** command is disabled.

Closing Scripts

To close the active script, use the **File | Close**command, the**Sheet | Close**command, or double-click the sheet tab of the sheet. Close all open scripts with the **Sheet | Close All**command.

Writing Scripts

To create a script, the script text is typed into the **Scripter** code window or an existing script is edited. When you want to create a new script, you will most likely start with an empty **Scripter** window and type the entire script. If you want to perform a routine task such as creating a graph, you can probably open an existing script file and edit the file to meet your specific needs. **Grapher** comes with several sample scripts that you can modify as desired.

Consider a script that creates a 3D XYY ribbon/wall plot:

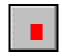
```
Sub Main
     'Create a programmable object to represent
     'the Grapher program
      Set GrapherApp = CreateObject("Grapher.Application")

     'Make the Grapher window visible
      GrapherApp.Visible = True

     'Assigns the Documents collection to the
     'variable named "Docs"
      Set Docs = GrapherApp.Documents

     'Creates a new plot window and assigns it to
     'a variable named "Plot"
      Set Plot = Docs.Add(grfPlotDoc)

     'Assigns the AutoShapes collection to
     'the variable named "Shapes"
      Set Shapes = Plot.Shapes

     'Creates a 3D XYY Ribbon/Wall Plot
      Shapes.Add3DLinePlotGraph(GrapherApp.Path +
     "\samples\bar chart orientations.dat")
End Sub
```

When you execute the script, **Grapher** is automatically started and a plot window is displayed. The graph is created. When the script execution is complete, the **Grapher** window remains open.

Running Scripts

Scripts are placed in the code window by typing a new script from scratch or by loading the script with the **File | Open** command. To run the script in the **Scripter** code window, select the **Script | Run** command, press the F5 key, or click the  button. **Scripter** examines the script instructions, and, if all the instructions are recognized, it begins to perform each instruction in turn.

More often than not, however, a newly typed script does not work correctly the first time it is run. Even simple typographical errors cause scripts to fail. For information on finding and fixing errors in scripts, see the Debugging Scripts.

Select the **Script | End** command or click the  button to stop executing a script. This may be necessary when you want to edit a script after a run-time error occurs, or when you accidentally start a script and you want to cancel the execution.

Running Scripts from the Command Line

You can run scripts from a command prompt without having to manually load and execute the script in **Scripter**. The same commands that you would type at a command prompt may also be entered as the "target" for a shortcut in order to link a shortcut button to a script. Enter the following to run a script from the command line or to link a shortcut to particular script file:

```
<Scripter path> -x filename.bas
```

where <Scripter path> represents the path to the **Scripter** program file (for example, C:\ Program Files\Golden Software\Grapher 15\Scripter\Scripter.exe") and filename.bas represents the name of the script to run. The space between the –x and the file name is required. This command opens theScripterwindow, loads the specified script file, and runs the specified script. When the script terminates - either successfully or unsuccessfully - theScripterwindow closes.

To load a script file but not execute it, the following command can be used:

```
<Scripter path> filename.bas
```

This opens the **Scripter** window and automatically loads the specified script file. The **Scripter** window remains open.

Passing a Command Line Argument to the Script

A single command line argument can be passed to a script. The command line argument can be any text that is used in the script. For example, a file name can be passed and used to create a graph. Enter the following to run a script with a command line argument:

```
<Scripter path> -x filename.bas command
```

where `command` represents the commands that should be passed to the script. Access the command line argument from the script using the `Command$` option. For example, if the script name is variable.bas and it can be run with any data file, you could use:

"c:\program files\golden software\Grapher 15\scripter\scripter.exe" -x "c:\temp\variable.bas c:\temp\data.dat

Do not quote the arguments in the command. To use the data in the script, use:

```
'Return the argument to the Immediate window
Debug.Print Command$

'Create a line/scatter plot from the data
Plot1.Shapes.AddLinePlotGraph(Command$)
```

Debugging Scripts

Bugs are errors in a script that keep it from performing as intended. Debugging is the process of locating and fixing these errors. The most common bugs are typographical errors in scripts or malformed instructions. **Scripter** detects these types of errors immediately when you try to run a script. The program beeps, highlights the line containing the error in red (or whatever color has been set with **View | Colors** command), and displays an error message on the status bar.

Viewing Errors

Before running a script, verify that the **View | Status Bar** command is enabled, or you will not see the error message. To resolve the errors that **Scripter** immediately detects, you usually must interpret the error message and correct the indicated problem. Typical errors are typing mistakes, unbalanced parentheses, misuse of a BASIC language instruction, or failure to declare variables in a DIM statement (if you use the OPTION EXPLICIT statement). If you do not see an obvious problem, refer to the online BASIC language help to make sure you are using the right syntax.

Run-Time Errors

Scripts that encounter errors midway through script execution may be fixed much the same way as syntax errors. The error message should guide your actions. Some run-time errors cannot be detected until they are executed, such as when you try to open a file that does not exist. In these cases, you need to check for error conditions in your scripts. For example, use the DIR function to make sure a file exists before trying to open it. Alternatively, you can use the ON ERROR GOTO statement to specify an error handling section to execute when a procedure encounters a run-time error:

```
Sub OpenFile(grf As Object, filename As String)
     On Error Goto ErrLabel
     grf.Documents.Open filename
     Exit Sub

     ErrLabel:
     MsgBox "Unable to open file " & filename
     Exit ' Must use RESUME or EXIT at end of error handling
     code
End Sub
```

Script Runs Incorrectly

Most difficult to correct are scripts which run but do not work as expected. Fixing these scripts is hard because you do not know which line or statement is causing the problem. **Scripter** provides a number of debugging features to help you locate the source of problems.

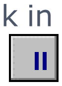
Debug.Print

Probably the simplest debugging technique is to insert instructions into your script to monitor the progress of the script and display the values of variables at various points throughout the script. Use the Debug.Print statement to display information in the **Scripter** immediate window:

```
Debug.Print "The value of variable X is "; X
```

To clear the contents of the immediate window, select the text in the window and press either DEL or BACKSPACE.

Stop or Pause

Insert the STOP instruction to pause script execution where you think there might be a problem. While the script is paused, you can examine and change the values of program variables. If a running script appears unresponsive, it may be stuck in an infinite loop. Select the **Script | Pause** command or click the  button to pause the script. To resume executing a paused script, select the **Script | Run** command or click .

Viewing Variable Values

While a script is paused, there are several ways to view the value of a variable:

- In the immediate window, type a question mark followed by the variable name and press ENTER. The current value of the variable is displayed.
- In the code window, place the cursor on the variable name you want to examine (that is, click on the variable name in the code window). Press SHIFT+F9, select the **Debug | Quick Watch** command, or click the  button on the toolbar. The current value of the variable is displayed in the immediate window.
- To continuously monitor a variable's value, click on the variable name in the code window, and press CTRL+F9 or select the **Debug | Add Watch** command. Alternatively, type the variable name in the watch window and press ENTER. The variable name and its value are displayed in the watch window. Every time script execution pauses, the variable value is automatically updated. To clear a variable from the watch window, highlight the line showing the variable value and press the DEL or BACKSPACE key.

Changing Variable Values

To change the value of a variable, type an assignment expression in the immediate window and press ENTER. For example, type "A=5" (without quotes) and press ENTER to assign a new value to the variable named "A."

Step

A powerful debugging technique is to watch **Scripter** execute your script one line at a time. This lets you check the effect of each instruction and verify that the script is doing what you expect. While stepping through a script, you can examine and change the values of script variables. Select the **Script | Run** command or click  to resume script execution at full speed after stepping through script instructions.

To execute your script one line at a time press the F8 key or select the **Debug | Step Into** command. The first line of the script is executed (or, if the script was paused, the next highlighted line is executed). The next line is highlighted and a yellow arrow appears to the left of the next line. To execute the highlighted instruction, press F8 again.

If a statement calls a subroutine or function that is defined within your script, the highlight will move into the called procedure. To keep from tracing execution into a called procedure, press SHIFT+F8 or select the

Debug | Step Over command. This executes the whole subroutine or function in a single step.

If you accidentally step into a procedure, press CTRL+F8 or select the **Debug | Step Out** command. This executes all remaining instructions in a procedure, and returns the highlight to the instruction that called the procedure.

If you do not see the next highlighted instruction, select the **Debug | Show Next Statement** command to scroll the highlighted line into view.

Sometimes you may want to skip the execution of some instructions or you may want to execute the same instructions several times without restarting the script. To change the next instruction line, click on the line you want to execute next and select the **Debug | Set Next Statement** command.

Breakpoint

Watching **Scripter** execute every line of the script may be too time consuming. In this case, a breakpoint pauses the script where you think there might be a problem. A breakpoint is a line of code that you mark. When **Scripter** encounters a line marked as a breakpoint, it pauses the script just as if it had executed a STOP instruction. Breakpoints are more convenient than STOP instructions because they may be set and cleared while a script is paused, whereas STOP instructions may be changed only after a script has ended.

To set a breakpoint, click in the break bar area next to the line you want to mark. The break bar is the area to the left of the code window, between the sheet tabs and the code window. Alternatively, click on the line you want to mark, and press F9 or select the **Debug | Toggle Break** command. The line becomes highlighted in red, and a round marker appears in the break bar area.

To clear a breakpoint, click on the round marker, or move the cursor to the marked line and press F9 or select the **Debug | Toggle Break** command again. You can clear all breakpoints by pressing SHIFT+CTRL+F9 or selecting the **Debug | Clear All Breaks** command.

A quick alternative to setting a breakpoint is the **Debug | Step To Cursor** command. This command has the same effect as setting a breakpoint on the current line, running the script, and then clearing the breakpoint after script execution has paused on the current line.

Trace

To check flow of execution through your script without having to watch each line of the script being executed, try using the TRACE function. To activate the trace function type "Trace" (without the quotes) in the immediate window and press ENTER. Trace On is displayed in the immediate window. As the script is run, the location of every instruction being executed is printed in the immediate window. After the script finishes, the trace function is automatically disabled.

Stack

If you nest procedure calls (that is, one procedure calls another procedure, which calls yet another procedure, and so forth), the stack window may be useful. When a script is paused, the stack window lists the procedures that have been called, and the order in which they were called. For instance, if the Main procedure calls procedure "A" which in turn calls procedure "B," the stack window displays three lines, one for each of the called procedures. Clicking on a line in the stack window moves the corresponding procedure into view in the code window.

Module Files

Click the loaded window tab in the immediate window area to see which module files are currently being interpreted by **Scripter**. The loaded files include the current script file and any modules it includes with the '#Uses statement.

Script Recorder

Grapher includes a **Script Recorder**, accessed through the **Automation | Scripts** commands. The **Script Recorder** records all commands as you make them in **Grapher**. When the script is run, **Grapher** performs all the steps for you. This is ideal for users that need to perform repetitive tasks but are unfamiliar with automation, for advanced users who do not want to manually enter all of the syntax, or for average users having difficulty with syntax. Check the box next to the **View | Display | Script Manger** command to display the **Script Manager** if you would like to view a script while it is recording. Recording must be stopped before editing scripts within the Script Manager.

Check the *Include script comments* box in the *General* section of the File | Options dialog to include comments when recording a script.

Run Script

Click **Automation | Scripts | Run** to run the script.

Stop Script

Click **Automation | Scripts | Stop** to end the running script.

Start/Stop Recording

Click **Automation | Scripts | Record** to start recording. The circle will turn red and the script will begin recording in the Script Manager.

Click **Automation | Scripts | Stop Recording** to stop recording. A **Save As** dialog will appear, allowing you to save the recorded script as a .BAS file. Click the *Save* button to save the script or click the *Cancel* button to close the dialog without saving the script.

Pause

Click **Automation | Scripts | Pause** to pause the recording or the currently running script. Resume recording by clicking the **Record** button. Resume a paused script by clicking the **Run** button.

Page Units

Page units are recorded when recording a script. This is so that items such as Width, Height, or Position are recorded appropriately. When running a recorded script, the page units are set to the recorded units. If other units are desired, delete the Plot.Windows.Item(1).PageUnits line near the top of the script. The page units of the current open plot window are used. This may result in incorrect locations or sizes of objects.

Custom Script Buttons

User scripts can be added to the **Automation | User Scripts** section of the Ribbon. A command button is created for the script. Click the button to run the script in the current **Grapher** window. Scripts that are used often can be placed in the ribbon for easy access. However, scripts that are not used repeatedly should still be run with the Automation | Scripts | Run command. A maximum of 21 scripts can be added to the ribbon.

The **Save and Export**, **Create scatter plot matrix**, and **Print All Open Documents** sample scripts are included in the **Developer | User Scripts** section of the ribbon by default.

Adding Scripts to the Ribbon

The **Automation | User Scripts | Add Scripts** command adds a script to the **Automation | User Scripts** section of the ribbon. The process to add a user script to the ribbon is as follows:

1. Click the **Automation | User Scripts | Add Scripts** button. The Open dialog is displayed.
2. Navigate to and select the desired script (*.BAS) file.
3. Click *Open* in the **Open** dialog.
4. The script is added to the **Automation | User Scripts** section. The command name is the script file name.

Running Scripts from the Ribbon

Click the button for the desired script and the script will run in the current **Grapher** window. If an issue occurs while the script is running, an audible Windows chime will play, and the script will appear in the Script Manager for editing.

Editing and Removing Script Buttons

To remove a script from the **Automation | User Scripts** section, right-click on the button and select **Remove** from the context menu.

It is possible to change the name of the button after the script has been added with the **Add Scripts** button. To change the button name, manually edit the UserTools.ini file located in the AppData directory (C:\Users\<user name>\AppData\Roaming\Golden Software\Grapher\13\. The entries are formatted as <Name>=<Full Path to BAS File.bas>. The *Name* value is displayed in the **Automation | User Scripts** list. The *Full Path to BAS File.bas* is the full path to the script file. This can be anywhere on the user's computer.

The **Automation | User Scripts** list can be shared between computers by copying and pasting the UserTools.ini file from one machine to the other. However the scripts must be located in the same location for the script buttons to work properly.

Object Browser

The **ActiveX Automation Members** dialog shows the methods and properties of the objects available to your script. This dialog provides a quick way to check the names of objects or to determine the argument list for a method.

In **Scripter**, choose the **Debug | Browse** command to open the **ActiveX Automation Members** dialog.

- The *Library* list shows object libraries available for use in the current script. These are the same libraries checked in the **References** dialog.

See the Type Library References for information about adding type library references in your script.

- The *Data Type* list shows objects available in the type library selected from the *Library* list.
- The *Methods/Properties* list shows methods and properties available from the object selected in the *Data Type* list.
- The text box along the top of the dialog demonstrates the usage of the selected method or property. Click the *Paste* button to insert this sample into the code window.
- Information about the item selected in the *Methods/Properties* list is shown along the right half of the dialog. The top line shows the selected item's type (function, property, or property get) and its name. The second line, labeled *Result*, shows the type of value returned by the method or property. The third line, labeled *Dispatch ID*, shows a value that uniquely identifies a property of method (this value is not used in scripts).
- If a method or property returns a reference to another object in the type library, the *Result* label is replaced by a button labeled *Follow Value*. Click the *Follow Value* button to see the definition of the object returned by the method or property. After clicking the *Follow Value* button, the *Back* button is enabled. Click the *Back* button to return to the definition you were previously viewing.
- The *Help String* group shows a short description of the item selected in the *Methods/Properties* list. Click the *?* button to view the help file associated with the type library. Not all type libraries have help files available.
- If the item selected in the *Methods/Properties* list is a method that accepts parameters, a *Parameters* list shows the names and types of all parameters used by the method.
- Click the *Close* button to dismiss the **ActiveX Automation Members** dialog.

Type Library References

Many application programs expose their services with objects. These objects may be used in your scripts, just as the **Grapher** automation objects are used. Before you can use another application's objects, you must add a reference the application's type library. A type library is a file that describes the objects, properties, and methods provided by an application. The **Grapher** type library is automatically referenced in **Scripter**.

To add a type library reference to the current script module in **Scripter**:

1. Select the **Edit | References** command to open the **References** dialog.
2. Click on the check box next to the type library whose objects you want to use in your script.
3. Click on the up and down arrows to adjust the relative priority of the checked references. If two libraries describe items with the same name, the item described in the higher-listed library is used by your script.
4. Click the *OK* button when finished adding type library references to your script.

Scripter BASIC Language

The online help describes the major elements of the **Scripter** BASIC programming language, but it does not explain the concepts of writing computer programs. Many good books on the subject of programming with BASIC (**B**eginner's **A**ll-purpose **S**ymbolic **I**nstruction **C**ode) have been written. If you are not moderately familiar with writing computer programs, we suggest that you refer to one of the books listed in the Suggested Reading topic.

Scripts are text files that contain a sequence of instructions to be carried out by the **Scripter** program. Each instruction specifies a task such as defining a variable or displaying a message on the screen. When the **Scripter** program processes the script, the instructions are carried out one at a time, from top to bottom.

Execution of a script begins with the first statement of the subroutine called `Main`. All scripts must therefore include the `Sub Main` and `End Sub` statements. Execution proceeds line-by-line until the end of the `Main` procedure, until an `End` statement is executed, or until an error occurs.

Basic Language

Program Statements

Statements are individual instructions to **Scripter** that carry out a specific operation. Statements are case insensitive and are typically written one to a line. To enter two or more statements on the same line, separate the statements with colons. For example:

```
a = 5 : b = 5 * a
```

Scripter BASIC requires flow control statements (IF, WHILE, DO, etc.) and declaration statements (DIM, PUBLIC, TYPE, SUB, etc) to be placed on a line by themselves.

Line Continuation

To break a line into two lines in **Scripter**, use a space followed by an underscore " _". You must include the space for the continuation to work properly in the script. A backslash continuation " \ " from earlier versions of **Scripter** is not supported. Comments are not allowed after the continuation character.

Example

```
Function ComputeSomething( filename As String, _
value_array() As Double ) As Double
```

Comments

Writing comments in your scripts to explain how they work can save you time and frustration when you later need to modify the script. The apostrophe character (') signals the start of a comment. **Scripter** ignores all text following the apostrophe up to the end of the line. Comments can be placed on their own line, or they may be placed at the end of a line.

Example

```
GrapherApp.Left = 60'Set the Left location of theGrapher-
window
```

In addition, you can use the REM statement to add a remark in the script. However, REM statements can only be used at the beginning of a line.

Double Quotes and Text

In **Scripter**, text strings must be enclosed in double quotes. File names, for example, must be surrounded by double quotes. If quotes are missing, the text may be mistaken for a variable name.

```
Debug.Print "This text string is printed in Scripter's imme-
diate window"
```

Operators

Operators are symbols that direct a script to perform basic calculations, such as addition, exponentiation, string concatenation, number comparison, and others. The language supports several arithmetic, comparison, and logical operators. In **Scripter**, select **Help | BASIC Language Help** command and search for "Operators" to see a complete list.

Flow Control

When you run a script, execution starts with the Sub Main statement and continues line-by-line until the End Sub statement at the end of the main procedure or until an End statement is encountered. Several flow control statements allow you to change this line-by-line progression according to conditions encountered by your script. The **Scripter** BASIC language includes a variety of looping and branching statements that is typical for modern programming languages. The flow control statements include the following (see the online BASIC language help for details on the syntax of these statements):

IF…END IF

IF...END IF executes a statement only if a condition if true. The alternate IF…ELSE…END IF form executes one statement if a condition is true and a different statement if the condition is false.

SELECT CASE…END SELECT

SELECT CASE...END SELECT branches to one of several statements. This compares the value of an expression to several test values and executes the statements associated with the test value that matches the expression value.

DO…LOOP

DO...LOOP is the basic looping statement. This statement loops either while a condition is true or until a condition becomes true and tests the condition either at the top of the loop or at the bottom of the loop.

This and all other loop structures may be stopped before the test condition has been met by placing an Exit statement in the body of the loop.

WHILE...WEND
WHILE...WEND loops while a condition is true and tests the condition at the top of the loop.

FOR...NEXT
FOR...NEXT loops a number of times and increments (or decrements) an index variable each time through the loop.

FOR EACH...NEXT
FOR EACH...NEXT iterates through all the elements in a collection object. Several **Grapher** automation objects are collection objects. The For...Each statement is a convenient way to process each element in a collection.

Example

The following code fragment closes all the documents contained in the Documents collection object:

```
'Assume that several documents are already
'open and that "GrapherApp" is the name of
'a variable which refers to the Grapher
'Application object
 Dim documents, doc As Object
 Set documents = GrapherApp.Documents
 For Each doc In documents
  doc.Close
Next
```

Optional Arguments

Many procedures, especially the methods provided by **Grapher** automation objects, accept a large number of arguments. Some of the arguments are required. Every required argument must be supplied or the script fails to run. Some arguments are optional. Optional arguments may be omitted and the procedure assumes a default value for the missing arguments.

For example, the Document object's PrintOut method accepts up to four arguments, all of which are optional:

```
plot.PrintOut(Method, Scale,
```

Since the arguments are optional, you can skip all or some of them when calling the procedure. To print at fifty-percent scale, for example, you would supply just the Scale argument value.

These arguments must be listed in the correct position, separated by commas, as shown below:

```
Set grf = CreateObject("Grapher.Application")
Set plot = grf.Documents.Add
plot.PrintOut(,50)
```

Although only one of the four argument values is supplied in this example, the appropriate number of commas must be used to mark the positions of the missing arguments.

Grapher automation objects do not support named arguments.

Subroutines and Functions

Writing a long or complicated script may be easier to manage if you divide the script into smaller pieces called procedures. A procedure is a separate sequence of instructions that you can call from multiple places within your script. The BASIC language provides many pre-defined procedures for performing frequently needed tasks, and, in fact, the methods provided by the **Grapher** automation objects are themselves procedures.

When you call a procedure, the instructions in the procedure are executed. When the procedure finishes its task, it returns control to the instruction that called the procedure. The **Scripter** BASIC language distinguishes two types of procedures: functions and subroutines. Functions return a value whereas subroutines do not.

Subroutines and functions may accept one or more values, called arguments. Arguments are passed to a procedure by listing them after the procedure name. If there is more than one argument, the arguments must be separated by commas. For example:

```
'Returns the cosine of the argument (returns 1)
 x = Cos(0)

'Returns the left-most characters (returns "Ag")
 a$ = Left("
```

```
'Waits for 5 seconds
 Wait 5
```

Cos, Left, and Wait are procedures built-in to the BASIC language.

The arguments passed to a function must be enclosed in parentheses if the function's return value is used. If the function's return value is not used, the arguments may be listed without enclosing them in parentheses. Arguments passed to a subroutine are never enclosed in parentheses.

Writing Subroutines

To define subroutines within a script, use the Sub statement. Subroutine and function definitions cannot be nested within other procedures. That is, the Sub statement must appear after the End Sub statement of any preceding subroutine definitions. The syntax for a subroutine definition is:

```
Subname ( arguments )
    statements
End Sub
```

where name represents the name you want to give to the subroutine, arguments represents a list of arguments names and types, and statements represents the instructions that comprise the body of the subroutine. There is no limit to the number of instructions you can include between the Sub and the End Sub lines. Consider the definition of a Main procedure and another subroutine:

```
Sub Main
   MultipleBeep 25   'call the MultipleBeep subroutine
End Sub

Sub MultipleBeep (count As Integer)
   For i = 1 To count
     Beep
     Wait 0.5 'Wait one-half second between beeps
   Next
End Sub
```

Each time the MultipleBeep procedure is called, the instructions between its Sub and End Sub statements are executed.

If the subroutine accepts arguments, the arguments are defined following the subroutine name using a format similar to the Dim statement. The argument definition list must be enclosed in parentheses, and argument definitions are separated by commas if there is more than one. When a subroutine is called, the variables listed in the argument list are automatically assigned the values passed in from the calling procedure.

Writing Functions

Functions are defined using the Function statement much the same as subroutines are defined with the Sub statement. Like subroutines, function definitions cannot be nested within other procedures. Unlike subroutines, functions can return a value to the calling procedure. The syntax of a function definition is:

```
Functionname ( arguments ) Astype
    statements
End Function
```

where name is the function name you want to use, arguments is a list of arguments names and types, type is the type of the value returned by the function, and statements are the instructions in the body of the function. To return a value from a function, assign a value to a variable with the same name as the function itself. For example:

```
Function hypotenuse(a As Double, b As Double) As Double
   'The built-in Sqr function computes the square root
   c = a * a + b * b

   'Set the function's return value
   hypotenuse = Sqr(c)
End Function
```

The list of arguments accepted by a function is defined the same way as you define the arguments accepted by subroutines.

Built-in Functions and Procedures

Numerous useful functions and subroutines are built into the **Scripter** BASIC language. These routines can help you perform some of the most commonly required programming tasks. Functions for processing strings, performing mathematical calculations, error handling, working with disk files, and many others are available.

If you are not already familiar with the Visual BASIC for Applications programming language, it will be worth your time to review the list of available routines. This list is found by selecting **Help | BASIC Language Help** in **Scripter**.

Variables

Variables

In **Scripter**, a variable is a symbolic name for a value. A variable name starts with a letter and may contain digits. Variable names cannot be the same as a reserved word. Because the **Scripter** code window displays variable names in black and reserved words in color, you can see when you have selected a variable name that conflicts with a reserved word.

Variables may be one of several types. The type of a variable determines what kind of data it may contain. See the following table for the possible variable types. In addition to the built-in data types, the **Scripter** language supports user-defined compound data types, user-defined enumeration types, and user-defined objects (defined in object modules and class modules).

The type of a variable is declared in a DIM statement. The syntax of a DIM statement is:

```
Dim varname As type
```

where varname is the name of the variable being declared and type is the variable's data type. Variables not declared in a DIM statement are a variant type, unless the variable name ends with one of the type-definition characters. If a variable name ends with one of the special type-definition characters, listed below, its type is recognized based on this character.

Type	**Type-Definition Character**	**Description of Type**
Integer	%	A 16-bit integer value
PortInt (Portable Integer)	?	A 16- or 32-bit integer value
Long	&	A 32-bit integer value
Single	!	A 32-bit floating-point value
Double	#	A 64-bit floating-point value
Currency	@	A 64-bit fixed-point value
String	$	A text string of any length
Byte	(none)	An 8-bit unsigned integer

		value
Boolean	(none)	A true or false value
Date	(none)	A 64-bit floating-point value
Object	(none)	A reference to an object
Variant	(none)	Capable of holding any type of value

Using the DIM statement to declare the variable type is optional. Variables can be used without first being declared in a DIM statement, but this practice is not recommended for any script longer than a few dozen lines. To enforce this policy, an OPTION EXPLICIT statement should be placed at the top of long scripts. The OPTION EXPLICIT statement makes it an error to use any variable without first declaring it. Using this option lets you find typographical errors in variable names before a script is run. Without this option, typographical errors in variable names are usually detected only when the script fails to produce the expected results.

Object Variables

In **Scripter**, object variables contain references to ActiveX objects. Creating the program Application object is an example of declaring an object variable:

```
Dim GrapherApp As Object
Set GrapherApp = CreateObject("Grapher.Application")
```

In this example, a DIM statement declares that the variable named `GrapherApp` holds a reference to an object. The built-in `CreateObject` function returns a reference to a **Grapher** Application object, and the SET statement assigns this object reference to the `GrapherApp` variable. Unlike variables of other types, which can be assigned new values simply with an equal sign (=), object variables must be assigned values with a SET statement.

Array Variables

Array variables store a list or table of values. A single variable name refers to the entire collection, and individual values are distinguished by their numeric indices (their "subscripts"). The maximum number of values that can be stored in an array must be defined in a `Dim` statement. The elements of an array are accessed by using the variable name followed by a left parenthesis, the index of an array element, and a right parenthesis.

```
Dim month(11) As String
month(0) = "January"
month(1) = "February"
…
month(11) = "December"
```

Array subscripts begin with zero, unless an Option Base statement is used at the start of a script. Notice that in the previous example an array whose maximum subscript value is 11 actually has room for twelve elements because the subscripts start with zero.

The `Dim` statement can reserve only a constant number of elements for an array. If the maximum number of elements cannot be known in advance, a dynamic array may be used. A dynamic array is an array whose number of elements can be changed while a script is running. The Redim statement changes the maximum number of values that can be stored in a dynamic array. Refer toHelp | BASIC Language HelpinScripterfor more information onDimandReDim.

User-Defined Types

A collection of related variables can be grouped together under one name. The TYPE statement defines the elements of a user-defined type.

```
Type measurement
julianday As Integer
level As Double
End Type
```

The TYPE definitions must appear at the top of a script file, before any subroutines. The TYPE…END TYPE statement defines a new type; it does not create a variable of that type. Variables of the user-defined type must be declared in a `Dim` statement. The elements of a user-defined type variable are accessed by using the variable name followed by a period and the element name:

```
Dim m As measurement
m.julianday = 192
m.level = 12.3
Debug.Print m.julianday ' prints 192 in the Immediate window
```

```
Debug.Print m.level ' prints 12.3 in the Immediate window
```

Global Variables

In **Scripter**, variables declared in the body of a subroutine or function are available only within that procedure. If you want to share the same variable throughout a script file, then you can define it at the top of the file, before any subroutine definitions. Variables declared at the top of the file are available to all subroutines in the file; hence, they are called "global" variables.

The PUBLIC keyword may be substituted for the `Dim` keyword to allow a global variable to be used in other modules.

Coordinate Arrays

Coordinates are passed to and from **Grapher** as arrays of doubles with alternating X and Y coordinates. For example, the triangle specified by the coordinates (x1,y1), (x2,y2), (x3,y3) would be passed in an array with the elements arranged like so: x1,y1,x2,y2,x3,y3. **Grapher** is flexible about the dimension of the array so long as the X and Y coordinates are contiguous (no empty elements) and alternating. To use arrays in **Grapher** from within VB:

1. Singly dimensioned array:

   ```
   Dim coordinates(1 to 6) As Double
   coordinates(1)=x1
   coordinates(2)=y1
   coordinates(3)=x2
   coordinates(4)=y2
   coordinates(5)=x3
   coordinates(6)=y3
   ```

2. Doubly dimensioned array:

   ```
   Dim Points(1 To 2,1 To NumPoints) As Double
   Points(1,1) = x1: Points(2,1) = y1
   Points(1,2) = x2: Points(2,2) = y2
   Points(1,3) = x3: Points(2,3) = y3
   ```

The first dimension is used for the X and Y coordinate, the second dimension refers to the vertex index.

3. You can use the Array statement for initialization, and then copy the results to a double array:

```
coordinates = Array(x1,y1,x2,y2,x3,y3)
dim Points(1 to 6) As Double
For i=1 to 6
Points(i) =
Next
```

Code, Class, and Object Modules

Code, Object, and Class Modules

If you create very large scripts, or frequently reuse the same subroutines in several different scripts, you may want to split your script code into more than one file. Each script file is called a module.

A script can call subroutines and functions defined in other modules. In addition to procedures, global variables, type definitions, and enumeration definitions may be shared among modules. Just as procedures make long scripts easier to manage and debug, modules make large script projects easier to manage.

Module Types

If you create very large scripts, or frequently reuse the same subroutines in several different scripts, you may want to split your script code into more than one file. Each script file is called a module.

A script can call subroutines and functions defined in other modules. In addition to procedures, global variables, type definitions, and enumeration definitions may be shared among modules. Just as procedures make long scripts easier to manage and debug, modules make large script projects easier to manage.

The **File | New Module** command in **Scripter** adds new code sheets to the workspace. Each sheet is stored in a separate file. When routines in one code sheet are used by other sheets, the code sheets are called modules. **Scripter** supports three types of modules:

- Code modules are used for stand-alone scripts and for storing libraries of useful procedures that can be called from other modules. The scripts described in this chapter are code modules, which contain a Main subroutine. Code modules without a Main subroutine cannot be run, but the routines contained in them can be shared by other scripts. Code modules are stored in files with a [.BAS] extension.
- Class modules are used to define objects that you can use in other modules. A class module defines the properties and methods that the object supports. Other modules access the object's properties and methods using the same syntax that is used to access **Grapher** automation objects. Unlike **Grapher** objects, new instances of the object defined in a class module are created using the NEW keyword. Class modules are stored in files with a [.CLS] extension.
- Object modules are identical to class modules, except that when a script uses the object defined in an object module, one instance of the object is automatically created. Additional instances of an object defined in an object module can be created with the NEW keyword. Object modules are stored in files with an [.OBM] extension.

The '#Uses Line

Before using the procedures and objects defined in another module, a script must indicate the name of the file containing the procedure or object definitions. You must place a '#Uses statement at the beginning of a script, before any procedure definitions, to instruct **Scripter** to load all modules used by the script.

Example

```
'#Uses "c:\
'#Uses "test.cls"
Sub Main
   'use the procedures and object defined in UTILS.BAS and
End Sub
```

Scripter does not permit cyclic '#Uses statements. That is, if module A uses module B, module B cannot use procedures from module A.

Private and Public Definitions

By default, all subroutines, functions, and user-defined types (including enumeration definitions) may be accessed from other modules. To prevent other modules from accessing procedures or user-defined types precede the definition with the Private keyword:

```
Private Sub MyBeep
   Beep : Beep
End Sub
```

In contrast to procedures, the global variables defined at the top of one module are not available to other modules unless they are declared using a Public statement. When used for variable declarations, the Public statement has the same syntax as the Dim statement:

```
Public universal_data As String
```

The names of all definitions, even private ones, are visible in other modules. To avoid errors due to name conflicts you must avoid using the same procedure, type, and variable names in more than one module. A common technique for avoiding name conflicts is to append a prefix to the names of global variables and procedures. For example, if you write a module of text-processing functions, you might prefix each function name with txt, e.g., txtFunction1.

Module Properties

To set the name by which other modules refer to an object defined in a class or object module, select the **Edit | Properties** command in **Scripter**. The **Edit Class Module Properties** dialog appears. Type the name that you want other scripts to use when referring to the object defined in the module. The instancing options control how other applications access the object defined in the module, but these options are not relevant to scripts executed within **Scripter**. Code modules do not have module properties.

When an object module is used in a script, one instance of the object defined in the module is automatically created. The name of the object that is automatically created is the name specified in the **Edit Object Module Properties** dialog.

Defining Object Properties and Methods

Class and object modules define the properties and methods of objects. To define the methods for an object, simply define public subroutines and functions. All the public procedures in a class or object module are methods that users of the object can call.

The properties of an object typically correspond to private global variables defined in the module. To allow users of the object to access the variable values, you provide "property get" and "property set" procedures. Use the Property Get statement to define a function that returns the value of a property. Use the Property Let statement (or the Property Set statement if the property is an object reference) to define a subroutine that changes the value of a property.

Two special subroutines are called when an object is first created and just before it is finally destroyed. In a class module, these subroutines are called "Class_Initialize" and "

Class Module Example

The following class module demonstrates how to define an object. The sample defines a property named Radius and a method named Draw.

```
'Declare a private global variable for
'storing the property called "Radius"
 Dim cirRadius As Double

'Define the initialization subroutine
 Private Sub Class_Initialize
   cirRadius = 99
End Sub

'Define the termination subroutine
Private Sub Class_Terminate
End Sub

'Define the "property get" function to
'retrieve the Radius property
Property Get Radius() As Double
   Radius = cirRadius
End Property
```

```
'Define the "property let" procedure to
'change the Radius value
Property Let Radius(val As Double)
   cirRadius = val
End Property

Sub Draw
   'Method performs some action here
End Sub
```

Creating Dialogs

Getting User Input

The **Scripter** language provides several predefined functions for prompting the script user for information. The `GetFilePath` function displays a standard Windows file open dialog. This allows the script user to select a file. The name of the selected file is returned by the function. The InputBox function allows the user to enter an arbitrary line of text. This function returns the line of text entered.

```
UserText$ = InputBox(Enter something here:) 'show prompt
Debug.Print UserText$ 'show line in Immediate window
```

In addition to these simple input routines, **Scripter** supports user-defined dialog boxes. You can design your own dialog boxes and process their input in any manner you choose.

Creating Dialogs

Scripter contains a dialog editor that you can use to design customized dialogs for use with automation. Select the **Edit | UserDialog Editor** command to visually design a dialog. You can control the size and placement of the components of the dialog, as well as customize the text included in the dialog.

Adding Items to the Dialog

To add a component to a dialog, first select from the palette of components at the left side of the dialog editor. After clicking a palette button, drag the mouse pointer diagonally in the dialog design area where you want to place the component. As you design the dialog, you can edit the properties of components you have placed in the dialog. To edit the properties of a component, double-click the item, click the right mouse button on the item, or select the component and click the  button. Every dialog must include an OKButton or a CancelButton, or both.

Saving a Dialog

When you have finished designing the dialog, click the  button. The code for the dialog is inserted into the script.

Editing a Dialog

To edit the dialog template after it has been inserted into the script, first move the cursor in the code window to any line between the BEGIN DIALOG statement and the END DIALOG statement. Next, select the **Edit | UserDialog Editor** command. The previously saved state of the dialog is shown in the dialog editor. When you save the dialog again, the previous dialog template is replaced with your changes.

Displaying the Dialog

To show your custom dialog in a script, first use the DIM statement to declare a variable as the UserDialog type, and then call the DIALOG function to display the dialog (see the example). The DIALOG function takes a user dialog variable as its argument and returns a number indicating which button was clicked to end the dialog. The DIALOG function returns -1 if the OK button was clicked, 0 if the cancel button was clicked, or an integer greater than zero if a push button was clicked (1 for the first push button listed in the dialog template, 2 for the second push button in the dialog template, and so forth).

If the return value is not needed, the DIALOG instruction may be called as a subroutine rather than as a function. In this case, do not enclose the dialog variable in parentheses. If the DIALOG instruction is called as a subroutine, however, the script ends with a run-time error if a cancel button is clicked.

Creating Multiple Custom Dialogs

To define more than one custom dialog in a script, you must place each dialog template in its own subroutine or function. If you try to define more than one custom dialog in the same procedure, **Scripter** shows an error indicating that the UserDialog type has already been defined.

Values in Dialogs

The values contained by dialog controls are accessed the same the way the fields of user-defined variable types are accessed. Type the dialog variable name, followed by a period, followed by the field name of the dialog component. Option button values cannot be accessed directly, but are accessed via the field name of their associated option group. The value of an OptionGroup is the number of the selected option button (the first option button in the group is 0, the second option button is 1, and so forth). You can initialize the values contained by dialog controls prior to showing the dialog, and retrieve the values entered in the dialog after it has been invoked.

UserDialog Items

Item	**Description**	**Properties**
GroupBox	A rectangle used to group related controls	Field, Caption
Text	A text label, requires no response from the user	Field, Caption
TextBox	An edit box used to enter and edit text	Field, Type (single line, multiple line, password)
CheckBox	A box which is checked and unchecked as the user clicks on it, a three-state check box has a disabled (grayed) state	Field, Caption, Type (2 state, 3 state, 3 state auto check)
OptionButton	A round button for choosing from a set of options, only one of a group of option buttons may be checked	Field, Caption, Option Group
ListBox	A window that contains a list of items that can be selected by the user	Field, Array of Items, Type (list, sorted list)
DropListBox	A list that is visible when opened by the user, the text may be editable or not and the list may be sorted or not	Field, Array of Items, Type (list, text, sorted list, sorted text)
ComboBox	A text box with an attached list box, the list may be sorted or not	Field, Array of Items, Type (text, sorted)
Picture	Displays a bitmap in the dialog	Field, Caption, Type (from file, from clipboard)
PushButton	A push button	Field, Caption
OKButton	Push button with the OK caption	Field
CancelButton	Push button with Cancel	Field

	caption	
Dialog	Definition of dialog box	Dialog Function, Caption, Centered

Properties:

- **Dialog Function**: The dialog function is the name of a special function that is called when various events happen in a dialog. Define a dialog function to control the behavior of a dialog and to retrieve its input.
- **Field Name**: The field name is the name used to refer to a component.
- **Caption**: The caption is the text displayed within a component.
- **Quoted**: When not quoted, the caption property gives the name of variable that contains the text to display for the caption. When quoted, the caption property is the literal text to display.
- **Array of Items**: The array of items is the name of a string array variable that contains the strings to display in a list. The array variable must be initialized before the dialog is invoked.
- **Type**: The type is the behavior of some components varies depending on which option is selected. Refer to the online help for descriptions of the available component types.
- **Option Group**: For option buttons, the field name is used to refer to a group of option buttons. Only one option button within a group may be checked.
- **Comment**: A comment is the text to insert in the dialog definition block.

UserDialog Example

The following function demonstrates how to define, display, and extract the values entered in a user dialog.

```
 Function MyInputBox As String
'Define the dialog template. This definition
'is inserted by the UserDialog editor.
 Begin Dialog UserDialog 250,112,"Caption"
 TextBox 10,14,230,28,.Text1
 CheckBox 20,49,160,14,"Check Box",.Check1
 OKButton 20,77,90,21
 CancelButton 130,77,90,21
 End Dialog
```

```
'Declare a dialog variable
 Dim dlgvar As UserDialog

'Initialize the dialog controls
 dlgvar.Text1 = "This is the initial text to display"
 dlgvar.Check1 = True ' start with check box checked

'Display the dialog and wait for the OK or Cancel
'button to be pressed
 result = Dialog(dlgvar)

'Extract the information entered into the dialog
 If result = -1 Then ' check to see if OK button was clicked
 MyInputBox = dlgvar.Text1
 If dlgvar.Check1 Then Debug.Print "The Check Box was
Checked!"
 End If
 End Function
```

To perform processing while a user dialog is active, define a special "dialog function." The dialog function is called when various dialog events occur. To define a dialog function:

1. While designing the dialog, double-click in a blank portion of the dialog design area to activate the **Edit UserDialog Properties** dialog.
2. Enter a name for the Dialog Function property of the dialog. This property gives the name of a function that is called when dialog events occur.
3. When you save the dialog, **Scripter** asks you if it should create a skeleton dialog function. Click the *Yes* button, and **Scripter** inserts the basic instructions for a dialog function into your script.

Refer to the DialogFunc help topic in theHelp | BASIC Language Helpfor more information about how to process dialog events in a dialog function.

BASIC Language Help

Click the **Automation | Help | BASIC Language Help** command to obtain help on BASIC programming commands.

Visual BASIC Compatibility

The **Scripter** BASIC programming language is compatible with the Visual BASIC for Applications language (VBA). Scripts that run in **Scripter** work in a VBA environment with few or no modifications. **Scripter** programs also work under Microsoft Visual BASIC. Unlike most Visual BASIC programs, however, **Scripter** programs are not event-driven. **Scripter** programs are procedural. They start with the first statement of the Main procedure, and end when the Main procedure ends.

VBA to Scripter
Some statements available in VBA are not supported in **Scripter** BASIC:

The VBA Collection object

The VBA Clipboard object

GoSub

On...GoSub

On...Goto

GoSub…Return

All Financial functions

Resume at current line

Erl

Option Compare

Conditional compilation

With Events

LinkExecute

LinkPoke

LinkRequest

LinkSend

Line numbers

LoadPicture

Multiple statements on one line (separated by ":")

Scripter to VBA
Conversely, some features of the **Scripter** BASIC language are not supported by VBA. Do not use the following features if you want to transfer your scripts from **Scripter** into VBA:

Clipboard function

CallersLine

User dialogs

PortInt

MacroRunThis

MacroDir

Wait instruction
MacroRun
DDEExecute
DDEPoke
DDERequest
DDEInitiate
DDETerminateAll
DDETerminate

Using Scripter Help

For information on **Scripter** program menu commands, select the **Help | Contents** command in **Scripter**. Press the F1 key for information about the **Scripter** windows or the active dialog. The **Help | Grapher Automation Help** command shows all **Grapher**-specific methods and properties.

The online help, shown when you select the **Help | BASIC Language Help** command (or press SHIFT+F1), explains all of the BASIC language statements and functions. Each help topic describes the purpose of a statement, and shows the syntax (the order of keywords and other symbols) to use when writing an instruction. The syntax examples in the online help use a shorthand method to explain the possible variations in usage:

`Sub, End, True`	Words with the initial letter capitalized indicate language-specific keywords.
<u>`name`</u>	Lower-case words with an underline (dotted in **Scripter** help) are placeholders for information you supply.
`[param]`	Items inside square brackets are optional. These may be omitted from the statement.
`{Until | While}`	Items between curly braces, and separated by a vertical bar are lists of options. You must use one of the items in list.
`[Private | Public]`	Items between square braces and separated by a vertical bar are lists of optional choices. You may use one of the items in the list, or none of them.
`...`	An ellipsis mark indicates that the preceding item in the syntax example is repeated. Repeated items are usually optional and separated by commas.

; , . ( )	Other symbols must be typed as shown in the syntax example, with the exception of the underscore "_" character, which is used to show that a sample line has been split.

Suggested Reading - Scripter

For additional help in learning how to program or for more information about the Visual BASIC for Applications (VBA) language (which is nearly identical to the **Scripter** BASIC language) we recommend the following books:

Harris, Matthew (1997), *Teach Yourself Visual BASIC 5 for Applications in 21 Days*, Third Edition, SAMS Publishing, Indianapolis, IN, 1248 pp.

Lomax, Paul (1998),VB and VBA in a Nutshell: The Languages,

Wang, Wallace (1998), *Visual BASIC 6.0 for Windows for Dummies*, IDG Books Worldwide, Foster City, CA, 477 pp.

Grapher Object Model

Grapher provides ActiveX automation objects that allow scripts to control practically every feature of **Grapher**. These objects can be accessed from **Scripter** or from any automation-enabled environment, such as Visual BASIC, Windows Scripting Host, or Excel.

Accessing Grapher

The means of accessing **Grapher** automation objects varies depending on the scripting tool and language being used. With the Golden Software **Scripter** program and other applications compatible with Visual BASIC, the CreateObject function creates a **Grapher** Application object:

```
Set x = CreateObject("Grapher.Application")
```

In this sample, a variable named "x" is assigned the value returned by the CreateObject function. The CreateObject function finds the name Grapher.Application in the system registry, activates **Grapher**, and returns a reference to the **Grapher** Application object. For an introduction to the **Scripter** programming language, see Scripter BASIC Language.

After creating an Application object, you can access other **Grapher** objects through the properties and methods of the Application object. These objects are organized in a hierarchy, with the Application object at the root. This object hierarchy is known as an object model.

Overview of Grapher Objects

Learning to use the **Grapher** automation objects in a script may appear daunting at first. Most tasks, however, can be accomplished using just a few **Grapher** objects. Once you become familiar with these primary objects and learn how to "drill through" the object hierarchy, you will be able to access most of **Grapher's** features from your scripts.

The online help is the complete reference for all of the **Grapher** automation objects, their properties, and their methods. The object model chart should serve as your guide for navigating through the object hierarchy.

The Derived Objects and Using Collection Objects topics show how to access the **Grapher** automation objects using the Scripter BASIC language. If you are not familiar with computer programming, you may benefit from a programming tutorial. See the Suggested Reading topic for recommendations.

Using Grapher Objects

To access **Grapher** commands from your script you must create a **Grapher** Application object. To create an Application object, call the CreateObject function with "Grapher.Application" as the argument. Every object has properties and methods associated with it. Properties are values describing the state of an object. Methods are actions an object can perform. Access properties and methods by typing the name of an object variable, followed by a period, followed by the property or method name.

You can use object properties as you would use variables: assign values to properties, branch based on the value of a property, or use the value of a property in calculations. An object's methods are called as you would call subroutines and functions. Use the return values from methods the same as you would use return values from functions.

When you "drill through" the object hierarchy, you can store references to intermediate objects in variables, or you can string together long sequences of object references. For example, you can set the default font for a plot document in a single line:

```
'Assume "grf" is a variable holding a reference
'to the Application object
 grf.Documents.Item(1).DefaultFont.Bold = True
```

Alternatively, you can store each intermediate object in variables as you traverse the object hierarchy:

```
'Assume "grf" is a variable holding a reference
'to the Application object
 Set docs = grf.Documents
 Set plot = docs.Item(1)
 Set font = plot.DefaultFont
 font.Bold = True
```

The second form - storing intermediate objects - is more efficient if you are performing several actions with the same object. A third alternative is to use the WITH...END

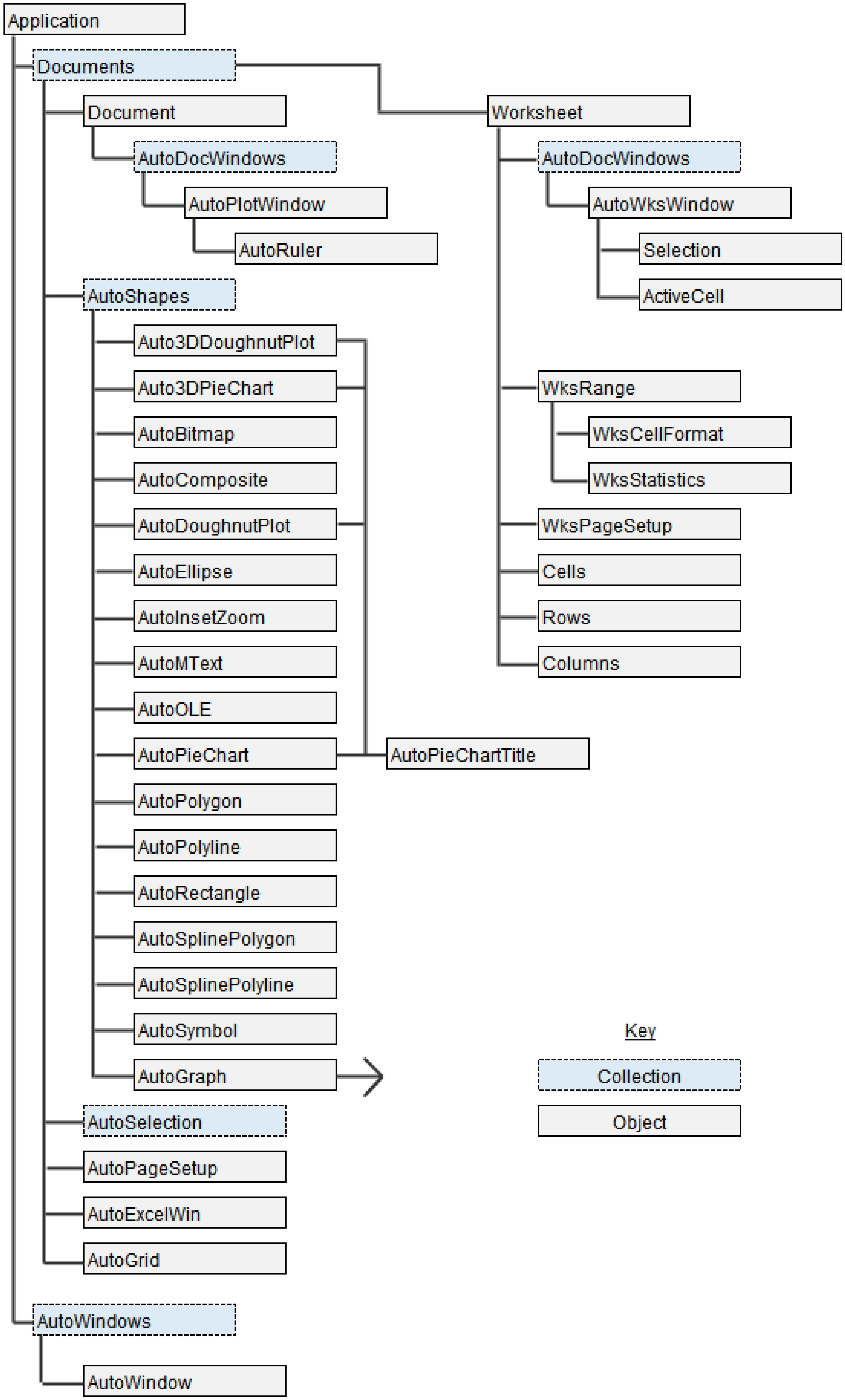
```
WITH statement:
'Assume "grf" is a variable holding a reference
'to the Application object
 With grf.Documents.Item(1).DefaultFont
  .Bold = True
  .Size = 12
  .Color = grfColorHotPink
 End With
```

Object Hierarchy

The object model chart shows you which objects provide access to other objects in the hierarchy. Although the Application object is at the top of the hierarchy, not all objects are directly accessible from the Application object. To access many objects you must traverse from the Application object through one or more layers of sub-objects. People often refer to "drilling" or "boring" through the object hierarchy to describe this traversal through several objects to obtain an object you want to use.

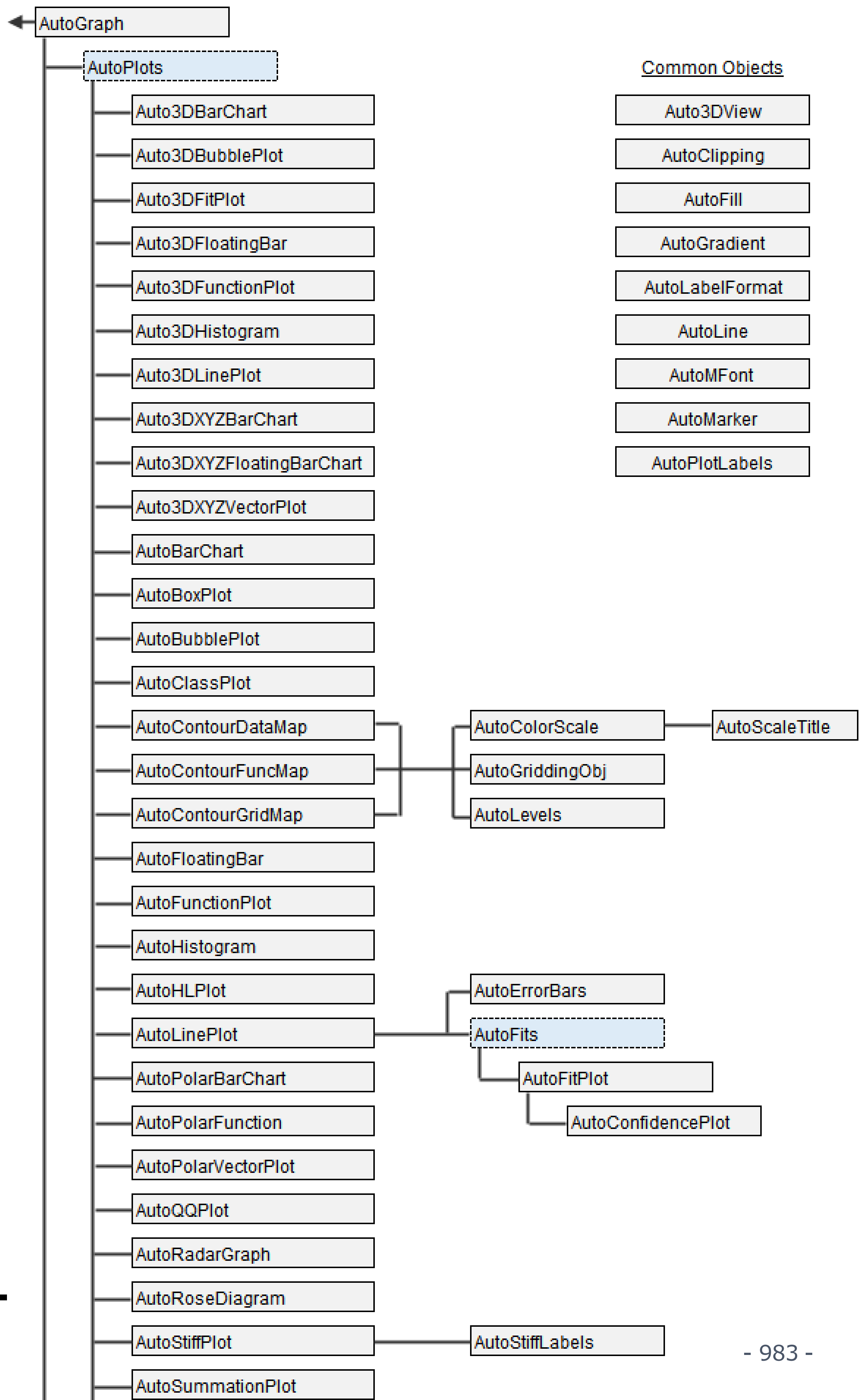
To "drill through" the object hierarchy you must know which properties and methods of an object provide access to the next level of objects. The next section, Overview of Grapher Objects, discusses the most commonly used objects and the properties and methods that provide access to other objects in the hierarchy.

Every object represents a specific part of **Grapher**. For example, the AutoRoseDiagram object represents a rose diagram, and the AutoAxis object represents an axis. Some objects do not represent a visible entity, but organize other objects into groups. The AutoShapes object, for example, provides the means to create new graphs and new drawing primitives (rectangles, symbols, polygons, etc.), but the AutoShapes object itself is never visible.


Application
Documents
Document
AutoDocWindows
AutoPlotWindow
AutoRuler
AutoShapes
Auto3DDoughnutPlot
Auto3DPieChart
AutoBitmap
AutoComposite
AutoDoughnutPlot
AutoEllipse
AutoInsetZoom
AutoMText
AutoOLE
AutoPieChart
AutoPolygon
AutoPolyline
AutoRectangle
AutoSplinePolygon
AutoSplinePolyline
AutoSymbol
AutoGraph
AutoSelection
AutoPageSetup
AutoExcelWin
AutoGrid
AutoWindows
AutoWindow
Worksheet
AutoDocWindows
AutoWksWindow
Selection
ActiveCell
WksRange
WksCellFormat
WksStatistics
WksPageSetup
Cells
Rows
Columns
AutoPieChartTitle
Key
Collection
Object

Click the arrow near AutoGraph to see the rest of the chart.

Hierarchy - AutoGraph Object


AutoGraph
AutoPlots
Common Objects
Auto3DBarChart
Auto3DBubblePlot
Auto3DFitPlot
Auto3DFloatingBar
Auto3DFunctionPlot
Auto3DHistogram
Auto3DLinePlot
Auto3DXYZBarChart
Auto3DXYZFloatingBarChart
Auto3DXYZVectorPlot
AutoBarChart
AutoBoxPlot
AutoBubblePlot
AutoClassPlot
AutoContourDataMap
AutoContourFuncMap
AutoContourGridMap
AutoFloatingBar
AutoFunctionPlot
AutoHistogram
AutoHLPlot
AutoLinePlot
AutoPolarBarChart
AutoPolarFunction
AutoPolarVectorPlot
AutoQQPlot
AutoRadarGraph
AutoRoseDiagram
AutoStiffPlot
AutoSummationPlot
Auto3DView
AutoClipping
AutoFill
AutoGradient
AutoLabelFormat
AutoLine
AutoMFont
AutoMarker
AutoPlotLabels
AutoColorScale
AutoScaleTitle
AutoGriddingObj
AutoLevels
AutoErrorBars
AutoFits
AutoFitPlot
AutoConfidencePlot
AutoStiffLabels

Click the arrow near AutoGraph to see the rest of the chart.

Collections

Several non-visible objects, called collection objects, are used to organize the object hierarchy. Collection objects are containers for groups of other, related, objects. For example, the AutoAxes collection contains all the AutoAxis objects associated with a graph.

All collection objects, regardless of what the collection contains, can be processed using similar techniques. Thus, you retrieve an object from a collection of plot windows (an AutoDocWindows collection) the same way you retrieve an object from a collection of axes (an AutoAxes collection). Collection objects also provide methods to create new objects.

Using Collection Objects

The **Grapher** object hierarchy includes several collection objects. Although these collections contain different types of data, they can be processed using similar techniques.

Count Property

All collection objects have a read-only property named Count that gives the number of objects in the collection.

Item Method

Every collection also has a method called Item that retrieves one of the objects contained in the collection. The Item method accepts a single argument specifying either an index number or (for most collections) the name of the object to retrieve. An index number is a value between one and the value returned from the collection's Count property. The name used to identify items is typically the object ID (for example, "Bar Chart 1" or "X Axis 1").

Add Method

Many objects have one or more Add methods for creating new items and adding them to the collection. For example, to add a rectangle to the AutoShapes collection, you would use the AddRectangle method:

```
Shapes.AddRectangle(2, 2, 4, 4)
```

Close and Delete Methods

The objects contained by collections are automatically removed when the contained object is deleted or closed. For example, call a Document object's Close method to close a document or call the AutoShape object's Delete method to remove any AutoShape-derived object.

Parent and Application Properties

Every automation object provides a Parent and an Application property. The Application property returns a reference to the top-level Application object. This is a convenient way to access the Application object, particularly when passing automation objects as arguments to subroutine and function calls.

The Parent property returns a reference to the collection object that an object is contained in, or the controlling object. If an object is not contained by a collection object, the Parent property typically returns a reference to the Application object.

Derived Objects

Several objects shown in the object chart share common features. For example, the AutoBarChart object and the AutoLinePlot object each have FirstRow and LastRow properties for selecting the range of worksheet rows to plot. These common features are inherited from a predecessor AutoPlot object.

Derived objects inherit all the properties and methods of the predecessor object. Derived objects and their predecessor objects include:

- The AutoShape object is a predecessor of the AutoPlot, AutoGraph, AutoPieChart, AutoAxis, AutoLegend, AutoRectangle, AutoEllipse, AutoSymbol, AutoMText, AutoPolyline, AutoPolygon, and AutoComposite objects.
- The AutoPlot object is the predecessor of the Auto3DXYZBarChart, AutoBarChart, AutoBoxPlot, AutoBubblePlot, AutoFitPlot, AutoFloatingBar, AutoFunctionPlot, AutoHistogram, AutoHLPlot, AutoLinePlot, AutoPolarBarChart, AutoRoseDiagram, and AutoTernaryPlot objects.

Note that since the various plot objects are derived from AutoPlot and since AutoPlot is itself derived from AutoShape, all of the plot objects also inherit the properties and methods of AutoShape.

Methods and Properties

Objects have attributes associated with them. The AutoTernaryPlot object, for example, has an attribute called zCol that represents the Z column used to create the plot. An object's attributes, also known as its ***properties***, may be examined and changed by scripts. Some properties may be examined, but may not be changed. These are called read-only properties.

In addition to having properties, many automation objects perform services. A Document object, for example, performs the SaveAs service when a script instructs it to do so. The services that an object performs are called its ***methods***. Methods often require parameters to control how their services are performed. The Document object's SaveAs method, for example, accepts two parameters: a file name and a file format code.

The way **Grapher** automation objects' properties and methods are accessed varies depending on the programming language you use. In the Golden Software **Scripter** language, properties and methods are accessed by typing the name of an object variable, followed by a period, and the name of the property or method:

```
Set x = CreateObject("Grapher.Application")
x.Visible = True
```

This sample creates an Application object and sets the Application object's Visible property to the special True value predefined by the **Scripter** language.

You can find all the properties and methods that are available for each of the automation objects, and a description of the objects, in the online help. To view the online help, select either the **Help | Automation Help** command in **Grapher**, or the **Help | Grapher Automation Help** command in **Scripter**. The ActiveX Automation Members dialog also shows you the available objects, properties, and methods. To view this dialog, select the **Debug | Browse** command in **Scripter**. See the Object Browser section of this chapter for information on this dialog.

Specifying Cell Coordinates

Cell coordinates can be specified in different ways depending on what you are selecting and which object you are using.

WORKSHEET OBJECT

Cell ranges can be specified in various ways for the Cells and Range methods:

1. Cells("A1") is a one argument single cell
2. Cells("A1:C5") is a one argument range of cells
3. Cells("A:E") is a one argument range of whole-columns
4. Cells("1:5") is a one argument range of whole-rows
5. Cells(Range object) is a one argument range of cells
6. Cells(1,"A") -or- Cells(1,1) is a two argument single cell
7. Cells("A1","C5") is a two argument range of cells
8. Cells(1,"A",5,"C") -or- Cells(1,1,5,3) is a four argument range of cells

Column ranges can be specified in various ways for the Columns method:

1. Columns(1,5) or ("A","E") is a two argument range of columns
2. Columns("A:E") is a one argument range of columns
3. Columns("A1:E1") is a one argument range of columns (the row coordinates are ignored)
4. Columns(Range object) is a one argument range of columns (the row coordinates are ignored)
5. Columns("A5") is a one argument single column (the row coordinate is ignored)
6. Columns(1) is a one argument single column

Row ranges can be specified in various ways for the Rows method:

1. Rows(1,5) is a two argument range of rows
2. Rows("1:5") is a one argument range of rows
3. Rows("A5:A10") is a one argument range of rows (the column coordinates are ignored)
4. Rows(Range object) is a one argument range of rows (the column coordinates are ignored)
5. Rows("A5") is a one argument single row (the column coordinate is ignored)
6. Rows(1) is a one argument single row

WKSRANGE OBJECT

Also, the Cells, Columns, and Rows methods work slightly differently when invoked on a WksRange object than when invoked on a Worksheet object.

When invoked on a WksRange object, the coordinates are relative to the upper-left corner of the range. For example, Range.Cells(A1) refers to whatever the upper-left corner of the range happens to be, like so:

```
 Set Wks = Grapher.Documents.Add(grfWksDoc)
 Set RangeObject1 = Wks.Cells(C5:E10)
'RangeObject2 now contains the cell "C5"
 Set RangeObject2 = RangeObject1.Cells("A1")

'RangeObject3 now contains the cell "C5"
 Set RangeObject3 = RangeObject1.Cells(1,1)

'RangeObject4 now contains the cell "D6"
 Set RangeObject4 = RangeObject1.Cells(2,2)
```

In addition, you can use a single numeric argument in the Range.Cells() method to sequentially access each cell in the range, like so:

```
'Note: RangeObject1 equals C5:E10
 Set RangeObject5 = RangeObject1.Cells(1) ; cell "C5"
 Set RangeObject6 = RangeObject1.Cells(2) ; cell "D5"
 Set RangeObject7 = RangeObject1.Cells(3) ; cell "E5"

'There are three cells in the first row of RangeObject1.
'Cell #4 is in the second row…
 Set RangeObject8 = RangeObject1.Cells(4) ; cell "C6"
 Set RangeObject9 = RangeObject1.Cells(5) ; cell "D6"
 Set RangeObject10 = RangeObject1.Cells(6) ; cell "E6"

'Cell #7 is in the third row…
 Set RangeObject11 = RangeObject1.Cells(7) ; cell "C7"
```

There are some special cases when the WksRange objects' Cells, Columns, and Rows methods are called. The behavior for these special cases is explained in these notes:

1. Coordinates are relative to the top, left of the current (base) range
2. The returned range can extend beyond the original range
3. Rows are limited to the original range if a whole-column sub-range is specified

4. Columns are limited to the original range if a whole-row sub-range is specified
5. Cells are indexed across and then down

Examples:

Item	**Base Range**	**Specified Sub-Range**	**Range Returned**
1	Wks.Range (B10:C20).	Cells("A1")	"B10"
2	Wks.Range (B10:C20).	Cells ("A1:C30")	"B10:D39"
3	Wks.Range (B10:C20).	Cells("A:C")	"B10:D20"
4	Wks.Range (B10:C20).	Cells("1:5")	"B10:C14"
5	Wks.Range (B10:C20).	Cells(n)	n=1 "B10", n=2 "C10", n=3 "B11", etc.

Columns are limited to the original range, the same as if a whole-row sub-range were supplied to the Range.Cells method.

Example

Base Range	**Specified Sub-Range**	**Range Returned**
Wks.Range (B10:C20).	Rows("1:5")	"B10:C14"

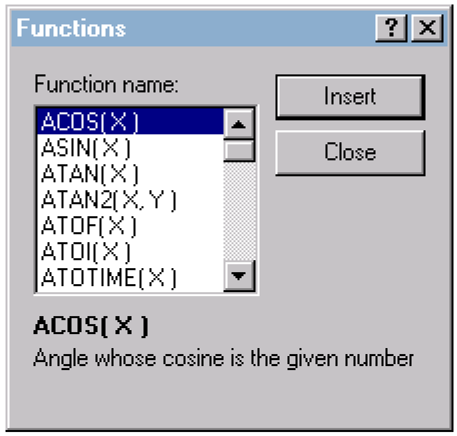
Rows are limited to the original range, the same as if a whole-column sub-range were supplied to the Range.Cells method.

Example

Base Range	**Specified Sub-Range**	**Range Returned**
Wks.Range (B10:C20).	Columns("A:C")	"B10:D20"

Functions

You can access the **Functions** dialog when creating a 2D function plot , a 2D polar function plot, a 3D XYY function plot, or defining a fit equation. The **Functions** dialog contains a list of mathematical functions available in **Grapher**.



*Select a mathematical function in the**Functions**dialog.*

Function Name

To use a function select the function from the *Functionname* list and click the *Insert* button.

Description

A description of the selected function is displayed below the *Function name* list.

Insert

Select a function from the *Function name* list and click the *Insert* button to insert the selected function into the previous dialog.

Close

Click the *Close*button to return to the previous dialog or Property Manager without inserting the function.

Mathematical Functions

Mathematical Functions are used to modify data with the Data Tools | Data | Transform command in the worksheet or create function plots in the plot window.

Data Types

The expression evaluator supports 32-bit signed integer numbers, double-precision floating-point numbers, a Boolean value, a text string of 0 to 256 characters, and time stamp values.

Variable Names

Variable names must begin with a column letter (i.e. A), row number (i.e. _1), or cell location (i.e. A2), which may be followed by other letters, numbers, or underscores (_), up to a maximum of 256 characters per variable name.

The variable names are not case sensitive. For example, **sum(a..z)**, **sum(A..z)**, and **sum(A..Z)** all refer to the same variable.

Precedence

The mathematical expression can consist of constants, variables (such as column letters), or functions (outlined below). The formulas follow standard precedence rules. Spaces are used in the equation for clarity.

Operators of equal precedence are evaluated from left to right within the equation. Parentheses are used to override precedence, and expressions within parentheses are performed first.

Operators, in order of decreasing precedence are:

( )	parentheses
-	minus (or negative sign)
^	exponentiation (raise-to-the-power-of)
* /	multiplication and division
+ -	addition and subtraction

The expression evaluator treats operators with the following precedence:

1. !, NOT, ~
2. ^, POW
3. *, /, %
4. +, -
5. <<, >>

6. <, >, <=, >=
7. ==,!=,<>
8. &
9. XOR
10. |
11. &&, AND
12. ||, OR
13. ?:
14. IF

Built-in Functions

The following built-in functions are supported:

Trigonometric Functions

All trigonometric functions are carried out in radians. If the data are in degrees, use the d2r(x) conversion function (in the *Miscellaneous Functions* section below) to convert degree data to radians and then use the trigonometric functions.

sin(x)	sine of angle x
cos(x)	cosine of angle x
tan(x)	tangent of angle x, the value of x must not be an odd multiple of Π/2.
asin(x)	Arcsine in the range -Π /2 to Π/2, x must be between -1 and 1
acos(x)	Arccosine in the range 0 to Π, x must be between -1 and 1
atan(x)	Arctangent in the range -Π/2 to Π/2
atan2(y,x)	Arctangent in the range -Π to Π

Bessel Functions

j0(x) j1(x) jn(n,x)	Bessel functions of the first kind at x of orders 0, 1, and n, respectively
y0(x) y1(x)	Return the Bessel functions of the second kind at x, of orders 0, 1, and n, respectively. For y0, y1, and yn, the value of x must not be negative.

yn (n,x)	

Exponential Functions

exp(x)	exponential function of x (e to the x)
sinh(x)	hyperbolic sine of angle x
cosh(x)	hyperbolic cosine of angle x
tanh(x)	hyperbolic tangent of angle x
ln(x)	natural logarithm of x, x must be positive
log10(x)	base 10 logarithm of x, x must be positive
pow(x,y)	x raised to the y^{th} power Alternatively use x^y Error conditions result if x is zero and y is negative or zero, x is negative and y is not an integer, an overflow results.

Miscellaneous Functions

min(x,y)	smaller of x and y
max(x,y)	larger of x and y
randn(x,y)	an approximately normally (Gaussian) distributed real random number with mean x and standard deviation y
randu(x)	a uniformly distributed real random number from the interval [0,x]
row()	row number
ceil(x)	smallest integer that is greater than or equal to x
floor(x)	largest integer less than or equal to x
pi()	returns the value of Pi. To limit to a specific number of digits, use Round(Pi(),y) where Y is the number of digits after the decimal point
round(x,y)	X rounded to the nearest number with Y digits after the decimal point
sign(x)	Evaluates the sign of x. Returns -1 when x < 0, returns 0 when x = 0, returns 1 when x > 0
sqrt(x)	square root of x, x must not be negative
fabs(x)	absolute value of x
fmod(x,y)	floating point remainder of x/y, if y is zero, fmod returns zero
d2r(x)	convert argument in degrees to radians, for example: sin(d2r(30)) computes the sine of

	30 degrees, sin(30) computes the sine of 30 radians
r2d(x)	convert argument in radians to degrees

Statistical Functions of an Interval

sum(a..z)	calculates the sum of a range of columns in a row
sum(_1.._5)	calculates the sum of a range of rows in a column
avg(a..z)	calculates the average of a range of columns in a row
avg(_1.._5)	calculates the average of a range of rows in a column
std(a..z)	calculates the (population) standard deviation of a range of columns in a row
std(_1.._5)	calculates the (population) standard deviation of a range of rows in a column
rowmin(a..z)	finds the minimum value of a range of columns in a row
rowmin(_1.._5)	finds the minimum value of a range of rows in a column
rowmax(a..z)	finds the maximum value of a range of columns in a row
rowmax(_1.._5)	finds the maximum value of a range of rows in a column

The statistical functions of an interval of columns operate row-wise on an interval of columns. For example, SUM(A..Z) computes the sum of the twenty-six columns A, B, C, ..., Z separately for each row. You can replace A..Z with any valid interval of columns, e.g., C..H or W..AC. There must be exactly two periods between the column labels. Columns may be given in reverse order, i.e., SUM(Z..A).

The statistical functions of an interval of rows operate column-wise on an interval of rows. For example, SUM(_1.._5) computes the sum of the 5 rows 1, 2, 3, 4, 5 separately for each column. You can replace _1.._5 with any valid interval of rows, e.g., _3.._12 or _34.._413. There must be exactly two periods between the row labels. Rows may be given in reverse order, i.e., SUM(_5.._1).

String Comparison

atof(x)	converts string to floating-point number

atoi(x)	convert a string x to an integer value
ftoa(x,y)	convert a floating-point number x to a string with y digits after the decimal
strlen(x)	length of string x in characters
strcmp(x,y)	compare string x with y and return 1 if x>y, -1 if x<y, or 0 if x=y
stricmp(x,y)	compare string x with y without regard to the case of any letters in the strings
strncmp (x,y,z)	compare the first z character of string x with y
strnicmp (x,y,z)	compare the first z characters of string x with y without regard to the case of any letters in the strings

String comparison functions work with strings, not numbers. Any rows or columns containing numbers result in blanks. In each of the string comparison functions, 1 is returned if string x is greater than string y, -1 is returned if string x is less than string y, and 0 if string x = string y. In the three-parameter comparison functions, the third parameter, z, specifies the number of characters to compare. For example, a z value of 3 compares the x and y strings' first three characters and ignores any characters after the third.

The comparisons are based on the standard ASCII table:

1. numeric values (disregarded in string comparisons as mentioned above)
2. cells starting with a space character
3. common punctuation
4. numeric text (numbers entered as text)
5. less common punctuation
6. uppercase letters
7. even less common punctuation
8. lower case letters
9. uncommon punctuation
10. blank cells (disregarded in string comparisons)

0	1	2	3	4	5	6	7	8	9
space	!	"	#	$	%	&	'	(	)
*	+	,	-	.	/	"0"	"1"	"2"	"3"
"4"	"5"	"6"	"7"	"8"	"9"	:	;	<	=
>	?	@	A	B	C	D	E	F	G
H	I	J	K	L	M	N	O	P	Q
R	S	T	U	V	W	X	Y	Z	[
\	]	^	_	`	a	b	c	d	e
f	g	h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y
z	{	|	}	~	blank				

This is the ASCII table order. The table is read left to right, top to bottom. Items appearing toward the upper left corner are less than the items appearing toward the lower left corner.

Boolean Expressions

Boolean expressions, include:

- **logical operators** (and, or, xor, not)
- **comparison operators** (=, <>, <, >, <=, >=)
- the **IF function**, i.e., IF(condition,true_value,false_value)

The words AND, OR, XOR, NOT, and IF are reserved keywords and may not be used as variable names.

Logical Operators *(and, or, xor, not)*

SYMBOL	NAME	DESCRIPTION
AND	AND	The result is true if both operands are true
&&	AND	The result is true if both operands are true
!	Logical NOT	Inverts the Boolean value. True becomes false, false becomes true
NOT	Logical NOT	Inverts the Boolean value. True becomes false, false becomes true
&	AND	The result is true if both operands are true
|	OR	The result is true if either of the two operands are true
XOR	Exclusive-OR (XOR)	The result is true only when the two operands are different
||	OR	The result is true if either of the two operands are true

OR	OR	The result is true if either of the two operands are true

Comparison Operators *(=, <>, <, >, <=, >=)*

SYMBOL	NAME	DESCRIPTION
~	Bitwise NOT	Inverts the bits in an integer
*	Multiple	Multiplies the two operands
/	Divide	Divides the first operand by the second
%	Remainder	Integer remainder of the first operand divided by the second
+	Add	Adds the two operands
-	Subtract	Subtracts the second operand from the first
<<	Shift Left	Shifts the operand to the left
>>	Shift Right	Shifts the operand to the right
<	Less Than	Result is true if the value of p1 is less than the value of p2
<=	Less Than or Equal To	Result is true if the ordinal value of p1 is less than or equal to p2
>	Greater Than	Result is true if the ordinal value of p1 is greater than p2
>=	Greater Than or Equal To	Result is true if the ordinal value of p1 is greater than or equal to p2
==	Equal To	Result is true if the operands have identical values
!=	Not Equal To	Result is true if the operands do not have identical values
<>	Not Equal To	Result is true if the operands do not have identical values

IF Function *IF(condition, true_value, false_value)*

SYMBOL	NAME	EXAMPLE	DESCRIPTION
IF	Conditional Evaluation	IF (p1,p2,p3)	IF(condition,true_value,- false_value) If p1 is true, the result will be p2. If p1 is false, the result will be p3
IF	Conditional Evaluation	p1?p2:p3	condition?true_value:false_ value If p1 is true, the result will be p2. If p1 is false, the result

			will be p3

Examples

The following are examples of mathematical function syntax. If you use Transform in the worksheet, replace X, Y, and Z with column letters (A is column A), row numbers (_1 is row 1), or cell locations (A1).

Equation	Mathematical Function Syntax
x^2	x^2 OR pow(x,2)
$\ln(x)$	ln(x)
$\log_{10} x$	log10(x)
$1-e^{-x}$	(1-exp(-X))
$1-e^{-x^2}$	1-exp(-x^2)
$1-\frac{\sin(x)}{x}$	1-(sin(x)/x)
$\frac{x^2}{1+x^2}$	x^2/(1+x^2)
$2x-x^2$	(2 * X)-pow(x,2)
$(x^2+y^2)(\sin(8\times\tan^{-1}xy))$	(pow(x,2)+pow(y,2))*(sin(8*atan (x*y)))

Math Text Instruction Syntax

The math text instruction set offers advanced formatting of text labels from the worksheet in **Grapher**. Math text instructions can be used to change the typeface, size, color, weight, and style of text on a character-by-character basis. Greek letters and mathematical symbols can be written using math text instructions. The math text instructions also allow for the detailed placement of characters and symbols; thus, superscripts, subscripts, and the superposition of characters are possible. The worksheet cells used as post labels in a post plot can contain math text instructions. In general, the clipboard can be used to cut and paste math text instructions.

Do not use math text instructions in the **Text Editor** as the Text Editor cannot use math text instructions. To use different text properties in the **Text Editor**, highlight the text to change and click the appropriate button or command in the dialog.

Unless otherwise indicated, all math text instructions begin with a backslash ("\"), and end with a single space. For example, the instruction "`\up50` " shifts the baseline of the text up 50 percent of the current text height. All characters from the beginning backslash through the ending single space are interpreted as instructions by the math text interpreter, and are not included in the resulting label.

Each line in a text block starts with the default text properties such as typeface, size, color, and style. (Note that some typefaces, such as Symbol, do not support bold or italicized text.) A line of text within a text block uses the current properties until a math text instruction is encountered. All text following an instruction is modified according to the instruction. For example, if the typeface is changed in the middle of a text string, the text following the instruction will use the new typeface until the end of the line of text is reached, or until another instruction affecting the typeface is encountered.

Encapsulate Math Text Instruction

Math text instructions can also be encapsulated so they are not carried out over an entire line. A left curly brace ("{") instructs the math text system to remember all of the text properties in effect at that point. A right curly brace ("}") restores the properties to what they were at the matching left curly brace. This allows the insertion of special text in the middle of an otherwise uniform text block. The only instructions this does not apply to are text baseline instructions (`\dnX` and `\upX`), and the position instructions (`\rpX` and `\spX`). Curly braces can be nested.

To incorporate a backslash, right curly brace, or left curly brace as a text character in a text block, precede them with a backslash when entering the text string. For example, "\\" produces "\", and "\{" produces "{".

Percentage Instructions

Instructions based on a percentage, such as font size, are cumulative. This means that a second percentage change within a text block is interpreted as a percentage of the first percentage change. For example, if the font is scaled by 50%, and later in the same text block the font is scaled by 50% again, the font size after the second percentage would be 25% of the original font size.

- Instruction names are case insensitive (`\fs50`, `\FS50`, `\Fs50` or `\fS50` are all valid).
- The `\sp` and `\rp` instructions only refer to positions on the same line.

Instructions that Change Typefaces, Sizes, and Styles

Math Text Instruction	Result
\b	All text after the \b command is bold.
\f"X"	Change to the typeface named X. These are the names listed in the Face drop-down list box in the **Text**dialog in the plot window. Typeface names are case sensitive. Enclose the face name in double quotes. If the typeface is not found, a generic stick typeface is used in place of the unfound typeface.
\fsX	Change font size to X% of current font size. For example, a value of 200 for X increases the font size by two, and a value of 50 for X decreases the font size by one-half.
\i	All text after the \i instruction is italicized.
\plain	This sets the text to "plain" text with normal weight, no italics, no under-lining, and no strikethrough.
\strike	Strikethrough the text.
\ul	All text after the \ul instruction is underlined.

Instructions that Change Text Color

Math Text Instruction	Result
The following instructions are provided to make it easy to set basic text colors:	
\black	Sets the text color to black.
\blue	Sets the text color to blue.
\green	Sets the text color to green.
\cyan	Sets the text color to cyan.
\red	Sets the text color to red.
\magenta	Sets the text color to magenta.
\yellow	Sets the text color to yellow.
\white	Sets the text color to white.
\gray	Sets the text color to gray.
The following instructions allow the text color to be set to an arbitrary RGB (Red,Green,Blue) value:	
\rgbrX	Sets the amount of red in an RGB text color (X=0 to 255).
\rgbgX	Sets the amount of green in an RGB text color

	(X=0 to 255).
\rgbbX	Sets the amount of blue in an RGB text color (X=0 to 255).
\rgbaX	Sets the alpha value in the RGBA text color (X=0 to 255).
\color (r,g,b,a)	Sets the amount or red, green, blue, and alpha value in the RGBA text color. r, g, b, and a are all a value between 0 and 255.

Instructions that Change Text Position

Math Text Instruction	Result
\dnX	Moves text baseline down X% of current font size (subscript). This instruction produces subscripts or returns the baseline to the original position following a \upX instruction. If a font size (\fsX) instruction follows the \dnX instruction, any subsequent \dnX or \upX instructions are relative to the changed font size.
\n	Creates a new line in the text block. This works similar to a carriage return - line feed combination. This should be used instead of the \dnX to create a new line of text.
\rpX	Restores the current position to position #X (X = 1 to 20). This instruction is used in conjunction with the \spX instruction. Any text following this instruction begins at the position defined with the \spX instruction. If the \rpX instruction is used without first setting a position with the \spX instruction, the position for the text is returned to the stating position for the text block.
\spX	Saves the current position as position #X (X = 1 to 20). The position is the up, down, left, and right areas within the text block. When the \spX instruction is used, the current location within the text block is assigned a position number. Return to this position using the \rpX instruction. Specify the position number assigned with the \spX

	instruction when using the \rpX instruction. These instructions are most useful when placing both superscript and subscripts after the same character.
\upX	Moves the text baseline up X% of current font size (superscript). This instruction is used to produce superscripts or to return the baseline to the original position following a \dnX instruction. If a font size (\fsX) instruction follows the \spX instruction, any subsequent \upX or \dnX instructions are relative to the changed font size.

Instructions Used to Insert Special Characters or Date and Time

Math Text Instruction	Result
\aX	Insert a character whose decimal code number is given by X (0 to 65535). In older non-Unicode aware software, this instruction is needed for characters with code numbers beyond the normal limits of the keyboard. For example, use the character code number to include an integral sign in a text string by specifying the character set, followed by the \aX command to specify the correct character number. For example, an integral sign is located at code position 242 in the symbol set called Symbol. Type \f"Symbol" \a242 for the integral sign to appear in the text block. The Character Map program is an accessory program in the Windows installations. Use the Character Map to display each of the available character sets and their designated code numbers. The code number is displayed in the right half of the Character Map status bar when a character is selected. In newer Unicode aware software, the need to use this directive occurs less

	often as one can simply copy/paste the letters or symbols needed from Character Map or any other Unicode aware software. Even if the character doesn't appear on your keyboard, can be entered by holding down the Alt key while typing the four digit hexadecimal code number for the special symbol you desire. See the Microsoft Windows documentation for further details.
\date	Inserts the current date. Be sure to follow this instruction with a space, even if no other text follows the date. The date is updated every time the text is redrawn.
\time	Inserts the current time. Be sure to follow this instruction with a space, even if no other text follows the date. The date is updated every time the text is redrawn.
\dt ("format")	Inserts the current date and/or time as indicated by a custom format string. Be sure to follow this instruction with a space, even if no other text follows the closing parenthesis. The date and or time is updated every time the text is redrawn.

Examples of Math Text Instructions

Due to page size limitations, some of these examples contain multiple lines of math text instructions. These examples must be entered on one line for the text to be displayed correctly.

Math Text Instruction	Result
CO\dn50 2	CO_2
x\up50 2	x2
\sp1 {\fs200 \f"Symbol" \a229 \sp2 }{\rp1 \dn90 \fs75 i=1\rp1 \up220 n}\rp2 \up25 X\dn50 {\fs75 i}\up50 Y\dn50 {\fs75 i}\up50 = S {\dn50 {\fs75 XY}\up50 }	$\sum_{i=1}^{n} X_i Y_i = S_{XY}$
{\i Avogadro} Constant = 6.022 x 10{\up50	*Avogadro* Constant = 6.022 x 1023

{\fs75 23}\dn50 }	
{\f"Symbol" \a209 } {\up50 {\fs50 2}\dn50 } {\f"Symbol" \a102 } = {\f"Symbol" \a182 } {\up50 {\fs50 2}\dn50 } {\f"Symbol" \a102 }/ {\f"Symbol" \a182 }x {\up50 {\fs50 2}\dn50 } + {\f"Symbol" \a182 } {\up50 {\fs50 2}\dn50 } {\f"Symbol" \a102 }/ {\f"Symbol" \a182 }y {\up50 {\fs50 2}\dn50 }	$\nabla^2\phi = \partial^2\phi/\partial x^2 + \partial^2\phi/\partial y^2$
{\fs200 N}\sp1 \up100 \fs75 5 \rp1 \dn50 1	N_1^5
sin{\up50 {\fs50 2}\dn50 }(X) + cos {\up50 {\fs50 2}\dn50 } (X) = 1	$\sin^2(X) + \cos^2(X) = 1$
104\f"Symbol" \a176 \f"Arial" 37'	104°37'
`a\dn25 {\fs75 c} \n ___ \n b\dn25 {\fs75 c}`	$\frac{a_c}{b_c}$
{\f"Symbol" d}\up50 {\fs75 234}\dn50 U	$\delta^{234}U$

Color Spectrum File Format

Color spectrum files [.CLR] are used to define a spectrum, or continuous gradation of colors. This is specified by a series of anchor points with associated colors. The colors between anchor points are interpolated from the nearest anchor points.

The basic format consists of an ASCII file with header information on the first line. Subsequent lines specify anchors points, one anchor point per line.

The header consists of the following space-delimited fields:

Element	Description
Id	case-sensitive string "ColorMap" without the quotes
Version	format version number, this should be set to 1

InterpMethod	interpolation method between anchors, this should be set to 1

Subsequent lines define the anchor points, one per line. Each line has the following space-delimited fields:

Element	Description
Position	The position is the floating point percentage value (from 0.0 to 100.0). Positions must be specified in increasing order from 0 to 100 percent, and the 0 and 100 percent positions must be specified in the file.
Red	red color component (0 to 255)
Green	green color component (0 to 255)
Blue	blue color component (0 to 255)

In the following example, the anchor points are at 0, 50, and 100. The zero position is blue, the 50 percent anchor is green, and the 100 percent position is yellow.

```
ColorMap 1 1
0     0     0     255
50    0     255   0
100   255   255   0
```

It is also possible to have coincident anchor points in a color file. Anchors and colors are interpreted in order from 0 percent to 100 percent. In the case of coincident points, you can create distinct boundaries, similar to the example shown here.

```
ColorMap 1 1
0     255   0     0
50    255   255   0
50    0     0     255
100   255   255   255
```

File Format Chart

File Form-at	Format Name	Coordi-nate Type[2]	Draw-ing Prop-erties[3]	Tex-t Blo-cks [4]	Con-tent Type [5]	Imp-ort[6]	Exp-ort[7]
000	IHO S-57 Nav-igation Chart	R			V	X[8]	
ACCD-B	Microsof-t Access				D	X[9, 10, 11]	
AN?	ACR-NEMA Medical Image	P			R	X[8]	
BLN	Golden Software Blanking	R			V	X[8, 9, 10, 11]	X[15]
BMP	Bitmap Image	P	X		R	X	X
BNA	Atlas Bound-ary	R			V	X[8, 9, 10, 11]	X[13,15]
CLP	Windows Clip-board	O	X	X	R and V	X	X
CSV	Comma Separ-ated Variable	R			D	X[9, 10, 11]	X[15]
CSV	XYZ Points	R			D	X[9, 10, 11]	X[13]
DAT	ASCII Data	R			D	X[9, 10, 11]	X[15]
DAT	XYZ Points	R			D	X[9, 10, 11]	X[13]
DBF	ASCII Data-base	R			D	X[9, 10, 11]	X[15]
DCM	DICOM3 Medical Image	P				X[8]	

DDF	SDTS TVP	R			V	X[8]	
DDF	USGS DEM Grid File				D	X[10, 11]	
DEM	USGS DEM Grid File				D	X[10, 11]	
DGN	Micro-station Design v7	R	some		V	X[8]	
DIC	DICOM3 Medical Image					X[8]	
DLG, LGO, LGS	USGS Digital Line Graph	R			V	X[8]	
DXF	AutoCAD Drawing	RO	some	som-e	D or V	X[8, 9, 10, 11]	X[13]
E00	Esri Arc Info Export	R		X	V	X[8]	
ECW	ER Map-per	P	X		R	X[8]	
EMF	Windows Enhance-d Meta-file	O	X	X	R and V	X[8]	X[13]
EPS	EPS Image	P	X		R		X
GDB	Esri File Geodata-base	R			V	X[8]	
GEOJ-SON	GeoJSO-N Data inter-change Format	R			V	X[8]	
GIF	Graphics Inter-change Format	P	X		R	X	X
GML	Geo-graphy	R			V	X[8]	

	Markup Language						
GPJ	Grapher Project					X[10,11]	X[14]
GPX	GPS Exchange	R			V	X[8]	X[13]
GRD[17]	Grid Files				D	X[10,11]	
GRF	Grapher File					X[10,11]	X[14]
GRT	Grapher Template					X[10,11]	X[14]
GSB	Golden Software Boundary	R			V	X[8]	X[13]
GSI	Golden Software Interchange	R	X	X	R and V	X[8]	X[13]
JP2	JPEG2000 Image	P	X		R	X	X
J2K	JPEG2000 Image	P	X		R	X	X
JPG	JPEG Image	P	X		R	X	X
JPG2000	JPEG2000 Image	P	X		R	X	X
LAS, LAZ	LiDAR Binary	R			D	X[9,10,11]	
MDB	Esri Personal Geodatabase	R			V	X[8]	
MDB	Microsoft Access				D	X[9,10,11]	
MID	MapInfo Interchange Data	R			D	X[9,10,11]	X[15]

MIF	MapInfo Inter-change	R	some	X	V	X[8]	X[13]
PDF	PDF Raster	P	X		R	X	X[13]
PDF	PDF Vector				V	X	X[13]
PLT	Golden Software PlotCall	O		X	V	X[8]	
PLY	Stanford	R			V	X[8]	
PNG	Portable Graphics	P	X		R	X	X
PNM, PPM, PGM, PBM	Portable Any Map File	P	X		R	X	X
RAS, SUN	Sun Raster Image					X[8]	X[13]
RGB, RGBA, BW	Portable Graphics	P	X		R	X	X
RT*	TIGER/Li-ne File Format	R			V	X[8]	
SEG	SEG-P1 Exchang-e Format	R			D or V	X[8, 9, 10, 11]	X[13]
SHP	Esri Shapefil-e	R			V	X[8]	X[13]
SID	Mr. Sid Image File	P	X		R	X	
SLK	Microsof-t SYLK	R			D	X[9, 10, 11]	X[15]
SP1	SEG-P1 Exchang-e Format	R			D or V	X[8, 9, 10, 11]	X[13]
SVG	Scalable Vector Graphics	R	X		R		X[13]
TAB	MapInfo Table	R	some		R	X[8]	

	File						
TGA	Targa TrueVision	P	X		R	X	X
TIF	Tagged Image File	P	X		R	X	X
TXT	ASCII Text Data	R			D	X[9, 10, 11]	X[15]
VCT	IDRISI Binary File	R			V	X[8]	
VTK	Visualization Toolkit				V	X[8]	
WMF	Windows Metafile	O	X	X	R and V	X[8]	X[13]
X, XIMG	AVS X-Image				R	X[8]	X[13]
XLS	Excel Spreadsheet	R			D	X[9, 10, 11, 12]	X[15,16]
XLSX	Excel 2007 Spreadsheet	R			D	X[9, 10, 11, 12]	X[16]
XLSM	Excel 2007 Macro Spreadsheet	R			D	X[9, 10, 11, 12]	

2 Coordinates in imported file, when digitizing, and when exporting:
R = real world coordinates such as latitude/longitude, UTM, etc.
P = pixel coordinates
O = other (page coordinates, metafile coordinates, etc.)

3 Contains properties such as line color, fill, etc.

4 Text blocks are editable. When the *All text as lines* option is chosen in the export options, the text is not editable.

5 Files can contain raster (bitmap) information, vector (lines) information, or both. There is no raster to vector conversion in **Grapher**. If you have a bitmap on screen and try to export it as a vector format, such as a DXF, the resulting file will be blank. If you have a bitmap on the screen and have drawn polylines or polygons and export as a vector format, only the drawing objects are included in the file. USGS SDTS DDF boundary files contain vector information (Topological Vector Profile). The DEM version of this file is considered a raster file (Raster Profile).

V = contains vector information only
R = contains raster to vector information only
R and V = contains raster and vector information
D = contains data

6 Importing in **Grapher** can be done with the **File | Import** or **File | Open** command. The **File | Import** and **File | Open** command in the plot document contains different file formats than the **File | Import** and **File | Open** command in the worksheet window.

7 Exporting in **Grapher** can be done with the **File | Export** command in the plot document, or the **File | Save As** command in the plot document or the worksheet window. The **File | Save As** command in the plot document contains different file formats than the **File | Save As** command in the worksheet window.

8 In the plot window, choose the **File | Import** command.

9 In the worksheet window, choose the **File | Import** command.

10 In the plot window, choose the **File | Open**command.

11 In the worksheet window, choose the **File | Open** command.

12 In the plot or worksheet window, choose the **File | Open Excel**command.

13 In the plot window, choose the **File | Export** command.

14 In the plot window, choose the **File | Save As** command.

15 In the worksheet window, choose the **File | Save As** command.

16 In the Excel window, choose the **File | Save As** command.

17 Includes GRD, DEM, HDR, DDF, DTED

File Formats in the Plot Document and Worksheet Window

The plot document and worksheet window commands import and export different file formats. Click the command to see the supported file formats.

Plot Window

File | Import

AN? ACR-NEMA Medical Image [.AN1, .AN2]
BLN Golden Software Blanking File
BMP Windows Bitmap
BNA Atlas Boundary
DICOM3 Medical Image
DDF SDTS TVP
DLG USGS Digital Line Graph [.DLG, .LGO, .LGS]
DXF AutoCAD Drawing
E00 Esri ArcInfo Export Format
ECW ERMapper
EMF Windows Enhanced Metafile
GIF Image
GSB Golden Software Boundary
GSI Golden Software Interchange
JPG Compressed Bitmap
MIF MapInfo Interchange Format
PCX (ZSoft Paintbrush)
PLT Golden Software PlotCall
PLY Stanford PLY
PNG Portable Network Graphics
PNM/PPN/PGM/PBM Image
RGB SGI-RGB Image
RT* TIGER/Line File
SHP Esri Shapefile
SID LizardTech MrSID Image
SUN Sun Raster Image
TGA Targa (TrueVision)
TIF Tagged Image
VTK Visualization Toolkit
WMF Windows Metafile
X AVS X-Image

File | Open
GRF - Grapher Files
GRT - Template Files
GPJ - Grapher Project
Excel 2007 Spreadsheet (.XLSX)
Excel Spreadsheet (.XLS)
Microsoft SYLK
DBF Database
Microsoft Access (MDB and ACCDB)
Comma Separated Variables (.CSV)
ASCII Data (.TXT)
Golden Software Data (.DAT)
Atlas Boundary (.BLN)
Golden Software Blanking (.BLN)
GRD - Grid Files (.GRD, .DEM, .HDR, .DDF, .DT0, ...)
File | Open Excel
Worksheet Files [.XLS, .XLSX]

File | Export
BLN Golden Software Blanking File
BNA Atlas Boundary
DXF AutoCAD Drawing
EMF Windows Enhanced Metafile
EPS Encapsulated Postscript
GIF Image
GSB Golden Software Boundary
JPG JPEG Compressed Bitmap
MIF MapInfo Interchange Format
PDF (Vector)
PDF (Raster)
PNG Portable Network Graphics
PNM/PPN/PGM/PBM Image
RGB SGI-RGB Image
SHP Esri Shapefile
SUN Sun Raster Image
TGA Targa (TrueVision)
TIF Tagged Image
WMF Windows Metafile
X AVS X-Image

File | Save As
Grapher File [.GRF]
Plot Template [.GRT]
Grapher Project [.GPJ]
Grapher Project 7.0 [.GPJ]
Grapher 7.0 File [.GRF]
Grapher Project 6.0 [.GPJ]
Grapher 6.0 File [.GRF]
Grapher Project 5.0 [.GPJ]
Grapher 5.0 File [.GRF]

Worksheet Window
File | Import
BLN Golden Software Blanking File
BNA Atlas Boundary
CSV Comma Separated Variables
DAT Data
DBF Database
MDB Microsoft Access
SLK Sylk Spreadsheet
TXT Text Data
XLS Excel Spreadsheet
XLSX Excel 2007 Spreadsheet

File | Open
GRF - Grapher Files
GRT - Template Files
GPJ - Grapher Project
Excel 2007 Spreadsheet (.XLSX)
Excel Spreadsheet (.XLS)
Microsoft SYLK
DBF Database
Microsoft Access (MDB and ACCDB)
Comma Separated Variables (.CSV)
ASCII Data (.TXT)
Golden Software Data (.DAT)
Atlas Boundary (.BLN)
Golden Software Blanking (.BLN)

GRD - Grid Files (.GRD, .DEM, .HDR, .DDF, .DT0, ...)

File | Save As

BLN Golden Software Blanking File

BNA Atlas Boundary

CSV Comma Separated Variables

DAT Data

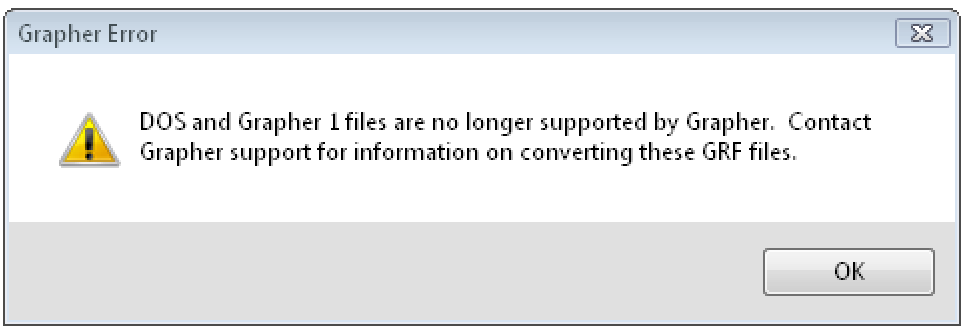
SLK Sylk Spreadsheet

TXT Text Data

XLS Excel Spreadsheet

Convert Older Grapher Files

Older files that were created in Grapher DOS and Grapher 1 cannot be opened by the current version of Grapher. When you try to open these files, you will see:



The error message appears when trying to open older Grapher GRF files.

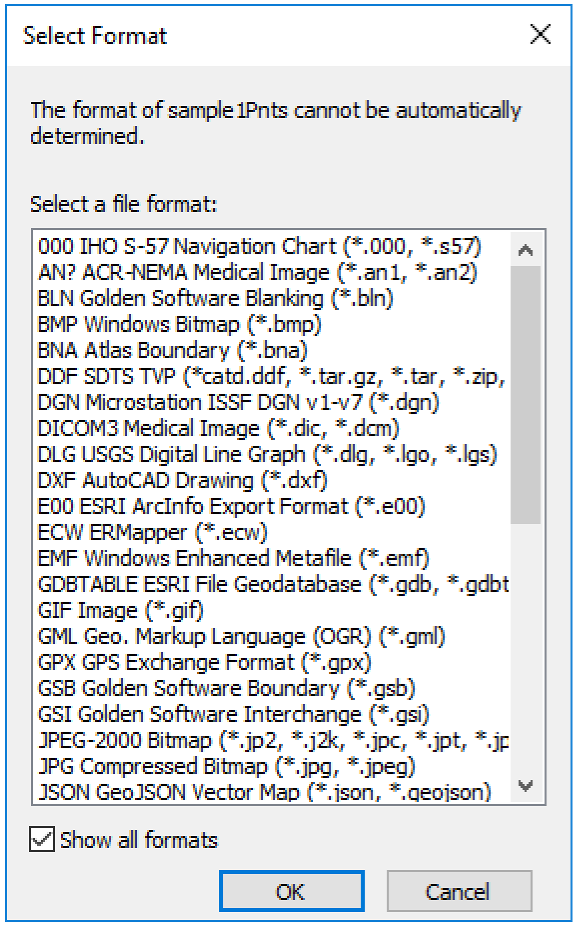
If you have an older copy of Grapher available, such as Grapher 2, 3, 4, 5, 6, or 7, it is recommended that you open the file in that version and save the GRF file using the new format. Once the file is saved in a newer format, it can be opened in the current version of Grapher.

If you do not have an older copy of Grapher available, use the online file converter at www.goldensoftware.com. Alternatively, send the GRF file and any associated data files to graphersupport@goldensoftware.com with a message that you need the older file converted. Technical support will convert the file for you and email you back the newer file.

Import File Types

If a file format is not recognized, select the type of file in the **File Types** dialog. If the file type is not in the dialog you cannot use the file directly.

Save the file in another program as a different format, or create a custom file extension.



Use the ***File Types*** *dialog to* Select a file type.

Select a File Type

Select a recognized file type from the *Select a file type* list.

Show All Formats

When the **Select Format** dialog first opens, **Grapher** lists the supported file types to the most likely file type for the selection. If the desired file type is not in the short list, check the *Show all formats* box and the list will include all supported file types. If the file type is not in the list, you will not be able to use the file directly. Save the file in another program as a different format.

File Descriptions

IHO S-57 Electronic Navigation Chart .000 File Description

Grapher imports International Hydrographic Organization S-57 Electronic Navigation Chart (ENC) .000 files. S-57 ENC files include point, polyline, and polygon features with attributes. S-57 files are typically used to view hydrographic data. S-57 .000 files may include feature update files with extensions .001, .002, etc. and text files with information about the data or collecting agency.

For detailed file structure information and for attribute definitions, see the *IHO Transfer Standard for Digital Hydrographic Data Publication S-57 Edition 3.1*.

Loading S-57 .000 Files

S-57 .000 files can be loaded with the File | Importcommand.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

No import options are available.

References:

IHO Transfer Standard for Digital Hydrographic Data. Publication S-57 Ed 3.1. Nov 2000. International Hydrographic Bureau. www.iho.int

IHO S-57 (ENC). Geospatial Data Abstraction Library. www.gdal.org

Microsoft Access .MDB and .ACCDB File Description

Microsoft Access .MDB is a binary database file format used by pre-2007 versions of Microsoft Access. The .ACCDB format is used in Access 2007 and 2010. **Grapher**can import data from tables and queries in both Access .MDB and .ACCDB formats.

Import Options

See Database Tables and Fields Dialog.

Import Automation Options

Microsoft Access .MDB Import Automation Options

Export Options

Grapher does not currently export Microsoft Access .MBD or .ACCDB files.

Microsoft Access (MDB) Import Options Dialog

If the .MDB file contains multiple tables, you can select which table to load in the *Choose Table To Load* list. The other controls in the dialog show previews of the data that will be imported. See Microsoft Access .MBD Import Options Dialog.

64-Bit Access Driver

In order to import Microsoft Access Database (*.mdb, *.accdb) files, you must have the Microsoft Access Database driver installed on your machine. It's shipped as part of the Microsoft Office suite and comes in 32-bit and 64-bit versions. Installing the 32-bit Microsoft Office suite will install the 32-bit Access Database driver. Installing the 64-bit Microsoft Office suite will install the 64-bit Access Database driver. Unfortunately, Microsoft doesn't allow BOTH to be installed simultaneously on a 64-bit Windows platform. If you need to import data from Microsoft Access Database files into Golden Software products, you must install the 32-bit version of our product if you have a 32-bit Access Database driver. You must install the 64-bit version of our product if you have a 64-bit Access Database driver. If you don't need to import Access Database data with our product, you may install either version on a 64-bit Windows platform.

AN? ACR-NEMA Medical Image

Digital Imaging and Communications in Medicine (DICOM) is a standard for handling, storing, printing, and transmitting information in medical imaging. It includes a file format definition and a network communications protocol. The communication protocol is an application protocol that uses TCP/IP to communicate between systems. DICOM files can be exchanged between two entities that are capable of receiving image and patient data in DICOM format. The National Electrical Manufacturers Association (NEMA) holds the copyright to this standard. It was developed by the *DICOM Standards Committee*, whose members are also partly members of NEMA.

DICOM enables the integration of scanners, servers, workstations, printers, and network hardware from multiple manufacturers into a picture archiving and communication system (PACS). The different devices come with DICOM conformance statements which clearly state the DICOM classes they support. DICOM has been widely adopted by hospitals and is making inroads in smaller applications like dentists' and doctors' offices.

Grapher imports images from DICOM 3 medical image data sets. This filter is also able to read some files written in the obsolete ACR-NEMA format (from which the DICOM format was derived); however, Golden Software does not officially support the ACR-NEMA format.

DICOM File Format

DICOM differs from other data formats in that it groups information into data sets. That means that a file of a chest X-Ray image, for example, actually contains the patient ID within the file, so that the image can never be separated from this information by mistake.

A DICOM data object consists of a number of attributes, including items such as name, ID, etc., and also one special attribute containing the image pixel data (i.e. logically, the main object has no "header" as such - merely a list of attributes, including the pixel data). A single DICOM object can only contain one attribute containing pixel data. For many modalities, this corresponds to a single image. But note that the attribute may contain multiple "frames", allowing storage of cine loops or other multi-frame data.

DICOM uses three different Data Element encoding schemes. With Explicit VR Data Elements, for VRs that are not OB, OW, OF, SQ, UT, or UN, the format for each Data Element is: GROUP (2 bytes) ELEMENT (2 bytes) VR (2 bytes) LengthInByte (2 bytes) Data (variable length). For the other Explicit Data Elements or Implicit Data Elements, see section 7.1 of Part 5 of the DICOM Standard.

The same basic format is used for all applications, including network and file usage, but when written to a file, usually a true "header" (containing copies of a few key attributes and details of the application which wrote it) is added.

File name extensions: DICOM .DIC, .DCM and ACR-NEMA .AN1, AN2.

Format(s) Supported for Import

- device-independent bitmap; 8, 24, 32 bit per pixel

Import Options Dialog

See DICOM Import Options Dialog.

Import Automation Options

See DICOM Medical Image File .DIC, .DCM Import Automation Options

Export Options Dialog

Grapher does not currently export .DIC, .DCM, .AN? files.

Loading Files

AN? ACR-NEMA medical image files can be loaded with the File | Import command.

Import Restrictions/Limitations

The DICOM specification allows an unusually wide variety of different formats and encodings within the same file format. While this software can read most of the common variants of DICOM, it would not be practical to develop software to read every possible variant. Some of the known deficiencies in this implementation include:

- DICOM images that contain bit per pixel counts other than 8, 12, 16, 24 or 32 may not be readable depending on the encoding and alignment of the data.
- DICOM images that are encoded with photometric interpretation models other than RGB, grayscale, or monochrome may not be readable. In particular, some YUV encodings cannot be imported.
- Some lossless JPEG images embedded in DICOM data sets do not import. In particular, images encoded with the "Cornell" JPEG codec are not always readable.
- Some of the obscure compression algorithms allowable under the DICOM specification are not supported by this software.
- Some ACR-NEMA files do not import. Golden Software does not officially support the obsolete ACR-NEMA file formats; however, **Grapher** does import many ACR-NEMA files successfully.

ASCII .DAT, .TXT, .CSV Data Files

ASCII files are generic format files that can be read or produced by most applications. There are three common ASCII data formats: .DAT, .CSV, and .TXT. These files can also be imported into most applications, including word processors, spreadsheets, and ASCII editors.

Worksheet Formatting

ASCII files do not contain any worksheet formatting information such as row height, column width, or cell formatting. When ASCII files are loaded into the worksheet, the default column formatting parameters are applied to the data. This does not result in any change to data, but might result in rounding of values in the data display. There is no limitation on the number of rows or columns in an ASCII format. ASCII formats save and load slowly because there is a conversion from binary numbers to character representation.

Format

There are some distinctions in formatting of ASCII files. Here are some brief notes that outline the usefulness of the ASCII file features.

- *Delimiters* control the separation between cell entries in a file. Spaces, tabs, semi-colons, or commas can be used to separate cells. If cell entries contain spaces in text, the comma or semi-colon delimiters are necessary if quotes are not used to qualify the text; otherwise, the text string would be interpreted as two cell entries rather than a single entry.
- *Placing Quotes around Text*. There are two types of entries in an ASCII file: values and text. Values are actual numbers; text can be any type of character, including numbers and text characters. Single or double quotes can be placed around text strings. If a number should be interpreted as text, surround it with double quotes. When text strings contain spaces, it is recommended to use single or double quotes around text cell entries.
- *Using Commas or Semicolons in Addition to Quotes*. Although double quotes are not required around text strings, they are useful when creating a space-delimited file that contains text. Often there are text strings that contain spaces, as in a date containing month name, day and year. With space delimited files this single entry is interpreted as more than one cell when loading this file into the worksheet. The safest way to eliminate this problem is to place double quotes around all text strings and use comma delimiting between variables.

Golden Software DAT Files

When a file is saved in the .DAT format, the Data Export Options dialog is displayed. If a file is in an ASCII text format with an unrecognized file extension, the Data Import Options dialog appears when opening the file.

ASCII Text

ASCII text files .TXT are tab delimited ASCII text files with no quotes around the text strings.

Comma Separated Variables

Comma separated variable files .CSV are comma delimited with double quotes around text strings (non-numeric or mixed alphanumeric).

When the computer's local setting has the *Decimal separator* as comma, .CSV are imported with commas as decimal separators and semi-colons as column separators. When the File | Options*Decimal separator* is manually set to comma, .CSV files also import with commas as decimal separators and semi-colons as column separators.

Import Options Dialog

Data Import Options Dialog

Import Automation Options

Data Import Automation Options

Export Options Dialog

Data Export Options Dialog

Export Automation Options

Data Export Automation Options

Golden Software Blanking .BLN File Description

Grapherimports and exports Golden Software Blanking Files .BLN.

Golden Software Blanking File .BLN is an ASCII format file used to store geographic information including areas, curves, and points. Spatial information is only concerned with the location of objects in space (i.e., their coordinates) and not with their attributes (i.e. line or fill style, marker symbol used, text labels, etc.). Even though the primary use of GS Blanking files is to indicate regions to be "blanked-out", they can also be used for simple boundaries and decorative illustrations.

File Format

The general format of the file is:

length,flag "Pname 1"
x1,y1
x2,y2
...
xn,yn
length,flag "Pname 2"

x1,y1
x2,y2
...
xn,yn

Length

The *length* value is an integer which indicates the number of X, Y coordinate pairs that follow.

Flag

The *flag* value is 1 if the region inside areas is to be blanked and 0 if the region outside areas is to be blanked.

Pname

Pname is optional and is the name of a primary ID to be associated with the object. The primary ID is used to link the object to external data.

X, Y Coordinates

Following lines contain the actual X, Y coordinate pairs that make up the object. These can be integers or real numbers, and are stored 1 pair per line.

Type of Object

The type of object is determined as follows:

- If the *type/length* field is 1, the object is considered a point. One coordinate pair follows.
- If the *type/length* field is greater than 1 and the first and last coordinate pairs are equal, the object is considered a simple closed area. Otherwise, the object is considered a curve.

Example 1

This example shows a simple .BLN file, with a single area:

```
5 0
1 1
1 3
4 3
4 1
1 1
```

Example 2

This example shows a complex .BLN file, with an island:

```
13 0
```

48 99
52 20
57 19
56 8
29 0
27 71
48 99
40 70
50 60
48 55
34 40
40 70
48 99

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

No import options are available.

Export Options Dialog

See BLN Options dialog and Scaling Export Options

Export Automation Options

See BLN Export Automation Options

Image (Bitmap) File Descriptions

A bitmap is an image displayed as an array of dots or "bits." In **Grapher**, images are typically imported with the **File | Import**command.

A typical BMP file usually contains the following blocks of data:

BMP File Header	Stores general information about the BMP file
Bitmap Information (DIB header)	Stores detailed information about the bitmap image.
Color Palette	Stores the definition of the colros being used for indexed color bitmaps.

Bitmap Data	Stores the actual image, pixel by pixel

The following sections discuss the data stored in the BMP file or DIB in details. This is the standard BMP file format.2 Some bitmap images may be stored using a slightly different format, depending on the application that creates it. Also, not all fields are used; a value of 0 will be found in these unused fields.

DIBs in memory

A BMP file is loaded into memory as a DIB data structure, an important component of the Windows GDI API. The DIB data structure is the same as the BMP file format, but without the 14-byte BMP header.

BMP file header

This block of bytes is at the start of the file and is used to identify the file. A typical application reads this block first to ensure that the file is actually a BMP file and that it is not damaged. Note that the first two bytes of the BMP file format (thus the BMP header) are stored in big-endian order. This is the magic number 'BM'. All of the other integer values are stored in little-endian format (i.e. least-significant byte first).

Offset#	**Size**	**Purpose**
0	2	the magic number used to identify the BMP file: 0x42 0x4D (Hex code points for **B**and**M**)
2	4	the size of the BMP file in bytes
6	2	reserved; actual value depends on the application that creates the image
8	2	reserved; actual value depends on the application that creates the image
10	4	the offset, i.e. starting address, of the byte where the bitmap data can be found.

Bitmap information (DIB header)

This block of bytes tells the application detailed information about the image, which will be used to display the image on the screen. The block also matches the header used internally by Windows and OS/2 and has several different variants. All of them contain a dword field, specifying their size, so that an application can easily determine which header is used in the image. The reason that there are different headers is that Microsoft extended the DIB format several times. The new extended headers can be used with some GDI functions instead of the older ones, providing more functionality. Since the GDI supports a function for loading bitmap files, typical Windows applications use that functionality. One consequence of this is that for such applications, the BMP formats that they support match the formats supported by the Windows version being run. See the table below for more information.

Size	**Header**	**Identified by**	**Supported by the GDI of**
40	Windows V3	BITMAPINFOHEADER	all Windows versions since Windows 3.0
12	OS/2 V1	BITMAPCOREHEADER	OS/2 and also all Windows versions since Windows 3.0
64	OS/2 V2		
108	Windows V4	BITMAPV4HEADER	all Windows versions since WIndows 95/NT4
124	Windows V5	BITMAPV5HEADER	WIndows 98/2000 and newer

For compatibility reasons, most applications use the older DIB headers for saving files. With OS/2 being obsolete, for now the only common format is the V3 header.

Color Palette

The palette occurs in the BMP file directly after the BMP header and the DIB header. Therefore, its offset is the size of the BMP header plus the size of the DIB header.

The palette is a block of bytes (a table) listing the colors available for use in a particular indexed-color image. Each pixel in the image is described by a number of bits (1, 4, or 8) which index a single color in this table. The purpose of the color palette in indexed-color bitmaps is to tell the application the actual color that each of these index values corresponds to.

A DIB always uses the RGB color model. In this model, a color is terms of different intensities (from 0 to 255) of the additive primary colors red (R), green (G), and blue (B). A color is thus defined using the 3 values for R, G and B (though stored in backwards order in each palette entry).

The number of entries in the palette is either 2n or a smaller number specified in the header (in the OS/2 V1 format, only the full-size palette is supported).24 Each entry contains four bytes, except in the case of the OS/2 V1 versions, in which case there are only three bytes per entry.4 The first (and only for OS/2 V1) three bytes store the values for blue, green, and red, respectively,2 while the last one is unused and is filled with 0 by most applications.

As mentioned above, the color palette is not used when the bitmap is 16-bit or higher; there are no palette bytes in those BMP files.

Bitmap Data

This block of bytes describes the image, pixel by pixel. Pixels are stored "upside-down" with respect to normal image raster scan order, starting in the lower left corner, going from left to right, and then row by row from the bottom to the top of the image.2 Uncompressed Windows bitmaps can also be stored from the top row to the bottom, if the image height value is negative.

RGB color (24-bit) pixel values are stored with bytes in the same order (blue, green, red) as in the color table.2

If the number of bytes matching a row (scanline) in the image is not divisible by 4, the line is padded with one to three additional bytes of unspecified value (not necessarily 0) so that the next row will start on a multiple of 4 byte location in memory or in the file. (the total number of bytes in a row can be calculated as the image size/bitmap height in pixels) Following these rules there are several ways to store the pixel data depending on the color depth and the compression type of the bitmap.

File Formats

The term image (bitmap) includes the following file formats:

- BMP Bitmap .BMP
- EPS Encapsulated Postcript .EPS
- GIF Graphics Interchange Format .GIF
- JPEG Compressed Bitmap .JPG
- PNG Portable Network Graphics .PNG
- PNM Portable Any Map Image .PNM, .PPM, .PGM, .PBM
- RAS Sun Raster Image .RAS, .SUN
- RGB Silicon Graphics RGB Image .RGB, .RGBA, .BW
- SID LizardTech MrSID Image .SID
- TGA TrueVision Targa .TGA
- TIF Tagged Image File Format .TIF, .TIFF

Import Options Dialog

See Image (Bitmap) Import Options Dialog

Import Automation Options

See Image (Bitmap) Import Automation Options

Export Options Dialog

See specific file types for export options.

See Size and Color for additional information.

Export Automation Options

See Image (Bitmap) Export Automation Options

Atlas BNA File Description

The Atlas boundary file .BNA is an ASCII format file used to store geographic information including areas, curves, ellipses, points, and IDs.

The general format of the file is:

```
"Pname 1", "Sname 1", type/length
x1,y1
x2,y2
...
xn,yn
"Pname 2", "Sname 2", type/length
x1,y1
x2,y2
...
xn,yn
```

Pname

Pname is the name of the primary ID. The primary ID is used to link the object to external data.

Sname

Sname is the name of the secondary ID. The secondary ID is optional.

Type/Length

The *type/length* is an integer which identifies the object as an area, curve, ellipse or point.

Following the *type/length* are the actual X,Y coordinate pairs that make up the object. These can be integers or real numbers, and are stored 1 pair per line.

The *type/length* field indicates the number of coordinate pairs to follow and also indicates the type of object as follows:

- Areas have a *type/length* value greater than 2. The value indicates the number of coordinate pairs to follow. Islands and lakes are concatenated to the coordinate list.
- Curves have a *type/length* value less than -1. The absolute value is the number of coordinates to follow for the curve.
- Ellipses have a *type/length* value 2. The first pair of coordinates describe the center of the ellipse. The major and minor radii are stored in the second pair of coordinates. If the minor radius is 0, the ellipse is a circle.
- If the *type/length* field is 1, the object is considered a point. One coordinate pair follows.

Simple and Compound Areas

Two kinds of areas exist, simple and compound. A simple area contains a starting point, a series of points specifying the area's boundary and a closing point with the same coordinate as the starting point. A compound area contains one or more subareas, such as islands or lakes. Atlas Boundary files use a special technique to specify the subareas comprising compound areas.

Example 1

A simple area with 5 points is shown in the Atlas Boundary file format:

```
"name" "attrib" 6
2.15, 3.25
3.75, 5.15
6.5, 4.3
5.5, 1.7
4.25, 3.4
2.15, 3.25
```

Example 2

A compound area consisting of a closed outer area and two islands. Here is how the coordinates should be specified in an Atlas Boundary file:

AX1,AY1	Starting point of area "A"
AX2,AY2	Points specifying boundary of area "A"

```
.
.
AXn,AYn       Ending point of area "A"
BX1,BY1       Starting point of subarea "B"
BX2,BY2       Points specifying boundary of subarea "B"
.
.
BXn,BYn       Ending point of subarea "B"
AX1,AY1       Starting point of area "A" (Flag Point)
CX1,CY1       Starting point of subarea "C"
CX2,CY2       Points specifying boundary of subarea "C"
.
.
CXn,CYn       Ending point of subarea "C"
AX1,AY1       Starting point of area "A" (Flag Point)
```

Each area's ending point must have the same coordinate as its starting point. The staring point of area "A" is used as a marker (called a Flag Point) to indicate the end of each subarea. This means the first area point's coordinate must be unique and cannot appear as a coordinate within any subarea.

And, an example of what the actual file may look like:

```
""pname"" ""attrib"" 13
48 99
52 20
57 19
56 8
29 0
27 71
48 99
40 70
50 60
48 55
34 40
40 70
48 99
```

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

See Atlas Boundary BLN Import Automation Options

Export Options Dialog

See Atlas Boundary BNA Export Options Dialog

Export Automation Options

See Atlas Boundary BNA Export Automation Options

ASCII Database .DBF File Description

Grapher imports data from and exports data to dBase/xBase database .DBF files.

Xbase is a complex of data files .DBF, indexes .NDX, .MDX, .CDX, etc. and eventually note files .DBT for storing large amounts of formatted data in a structured form.

DBase's database system was one of the first to provide a header section for describing the structure of the data in the file. This meant that the program no longer required advance knowledge of the data structure, but rather could ask the data file how it was structured. Note that there are several variations on the .DBF file structure, and not all dBase-related products and .DBF file structures are necessarily compatible.

A second filetype is the .DBT file format for memo fields. While character fields are limited to 254 characters each, a memo field is a 10-byte pointer into a .DBT file which can include a much larger text field. DBase was very limited in its ability to process memo fields, but some other xBase languages treat memo fields as strings just like character fields for all purposes except permanent storage.

DBase uses .NDX files for indexes. Some xBase languages include compatibility with .NDX files while others use different file formats.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

No import options are available.

Export Options

See DBF ASCII Database Export Options Dialog

Export Automation Options

See DBF ASCII Database Export Automation Options

SDTS Topological Vector Profile and Raster Profile (TVP, DDF) File Description

Grapher can import USGS SDTS Topological Vector Profile .TVP or .DDF data sets.

SDTS File Information

The Spatial Data Transfer Standard, or SDTS, is a robust way of transferring earth-referenced spatial data between dissimilar computer systems with the potential for no information loss. It is a transfer standard that embraces the philosophy of self-contained transfers, i.e. spatial data, attribute, georeferencing, data quality report, data dictionary, and other supporting metadata all included in the transfer.

The purpose of the SDTS is to promote and facilitate the transfer of digital spatial data between dissimilar computer systems, while preserving information meaning and minimizing the need for information external to the transfer. Implementation of SDTS is of significant interest to users and producers of digital spatial data because of the potential for increased access to and sharing of spatial data, the reduction of information loss in data exchange, the elimination of the duplication of data acquisition, and the increase in the quality and integrity of spatial data. SDTS is neutral, modular, growth-oriented, extensible, and flexible--all characteristics of an "open systems" standard.

The SDTS provides a solution to the problem of spatial data transfer from the conceptual level to the details of physical file encoding. Transfer of spatial data involves modeling spatial data concepts, data structures, and logical and physical file structures. To be useful, the data to be transferred must also be meaningful in terms of data content and data quality. SDTS addresses all of these aspects for both vector and raster data structures.

There are two separate types of SDTS DEM files: topological vector profile SDTS and raster profile SDTS files.

TVP

The topological vector profile SDTS files contain boundary line information and can be used as an imported file using the **File | Import** command.

DDF

The raster profile SDTS files contain gridded elevation information and can be used to directly create a grid-based map (i.e. **Graph | Contour Maps | XY Grid**). An uncompressed SDTS contains several files with the .DDF extension. All of the .DDF files are necessary to produce a map (i.e. you cannot copy just one .DDF file and create a map from it). You can choose any of the .DDF files when importing a base map with the Topological Vector Profile SDTS files.

Remarks

When you unzip the tar.gz file containing the DDF files, there is an option in WinZip (or other unzipping software) that needs to be disabled. UsetheWinZip settings to disable this option.

1. In WinZip, use the **Options | Configuration**command to open the**Configuration**dialog.
2. Click on the*Miscellaneous* tab.
3. In the *Other* category, un-check *TAR file smart CR/LF conversion.*
4. Click the*OK*button.
5. The Tar.GZ file willnow properly unzip the files.

Import Options Dialog

SDTS TVP Import Options Dialog

Import Automation Options

SDTS TVP Import Automation Options

Export Options Dialog

Grapher does not export SDTS .DDF files.

SDTS Digital Elevation Model .DEM File Description

Grapher imports elevation data in the form of a uniform lattice from SDTS Digital Elevation Model .DEM data sets.

There are two separate types of SDTS DEM files. The Topological Vector Profile SDTS files contain boundary line information and can be used with **File | Import**.

The Raster Profile SDTS files contain gridded elevation information and can be used to directly create a grid-based map such as a contour map. An uncompressed SDTS contains several files with the .DDF extension. All of the .DDF files are necessary to produce a map (i.e. you cannot copy just one .DDF file and create a map from it). You can choose any of the .DDF files when importing a base map with the Topological Vector Profile SDTS files.

Format(s) Supported for Import

2D uniform lattice; 8-, 16-, 32-bit integer, float, double

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

No import options are available.

Export Options Dialog

Grapher does not currently support SDTS export.

Intergraph/Microstation Design v7 .DGN File Description

Grapher imports Microstation Design v7 .DGN files. DGN files are created by MicroStation and Intergraphs's Interactive Graphics Design System (IGDS). DGN files are binary CAD data files that include point, polyline, polygon, and text features with attributes. **Grapher** can also import v6 and older version DGN files. DGN files include file set-up information, graphic elements, and non-graphic data.

Some feature style and color information is maintained when importing DGN files.

Grapher does not import DGN v8 files at this time.

Loading Microstation DGN v7 Files

Microstation DGN v7 files can be loaded with the File | Import command.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options
No import options are available.

References:

MicroStation 95 Reference Guide. Ch 18, pg 18-1. Bentley Systems.

DGNLib: a Microstation DGN (ISFF) Reader. Warmerdam, Frank. dgnlib.maptools.org

Microstation DGN. Geospatial Data Abstraction Library. www.gdal.org

DICOM3 Medical Image .DIC, .DCM File Description

Digital Imaging and Communications in Medicine (DICOM) is a standard for handling, storing, printing, and transmitting information in medical imaging. It includes a file format definition and a network communications protocol. The communication protocol is an application protocol that uses TCP/IP to communicate between systems. DICOM files can be exchanged between two entities that are capable of receiving image and patient data in DICOM format. The National Electrical Manufacturers Association (NEMA) holds the copyright to this standard. It was developed by the *DICOM Standards Committee*, whose members are also partly members of NEMA.

DICOM enables the integration of scanners, servers, workstations, printers, and network hardware from multiple manufacturers into a picture archiving and communication system (PACS). The different devices come with DICOM conformance statements which clearly state the DICOM classes they support. DICOM has been widely adopted by hospitals and is making inroads in smaller applications like dentists' and doctors' offices.

Grapher imports images and lattices from DICOM 3 medical image data sets. This filter is also able to read some files written in the obsolete ACR-NEMA format (from which the DICOM format was derived); however, Golden Software does not officially support the ACR-NEMA format.

DICOM File Format

DICOM differs from other data formats in that it groups information into data sets. That means that a file of a chest X-Ray image, for example, actually contains the patient ID within the file, so that the image can never be separated from this information by mistake.

A DICOM data object consists of a number of attributes, including items such as name, ID, etc., and also one special attribute containing the image pixel data (i.e. logically, the main object has no "header" as such - merely a list of attributes, including the pixel data). A single DICOM object can only contain one attribute containing pixel data. For many modalities, this corresponds to a single image. But note that the attribute may contain multiple "frames", allowing storage of cine loops or other multi-frame data.

DICOM uses three different Data Element encoding schemes. With Explicit VR Data Elements, for VRs that are not OB, OW, OF, SQ, UT, or UN, the format for each Data Element is: GROUP (2 bytes) ELEMENT (2 bytes) VR (2 bytes) LengthInByte (2 bytes) Data (variable length). For the other Explicit Data Elements or Implicit Data Elements, see section 7.1 of Part 5 of the DICOM Standard.

The same basic format is used for all applications, including network and file usage, but when written to a file, usually a true "header" (containing copies of a few key attributes and details of the application which wrote it) is added.

File name extensions: DICOM .DIC, .DCM and ACR-NEMA .AN1, AN2.

Format(s) Supported for Import

- device-independent bitmap; 8, 24, 32 bit per pixel
- uniform lattice; 8-, 16-, 32-bit integer, float, double

Import Options

See DICOM Import Options Dialog.

Import Restrictions/Limitations

The DICOM specification allows an unusually wide variety of different formats and encodings within the same file format. While this software can read most of the common variants of DICOM, it would not be practical to develop software to read every possible variant. Some of the known deficiencies in this implementation include:

- DICOM images that contain bit per pixel counts other than 8, 12, 16, 24 or 32 may not be readable depending on the encoding and alignment of the data.
- DICOM images that are encoded with photometric interpretation models other than RGB, grayscale, or monochrome may not be readable. In particular, some YUV encodings cannot be imported.
- Some lossless JPEG images embedded in DICOM data sets do not

import. In particular, images encoded with the "Cornell" JPEG codec are not always readable.

- Some of the obscure compression algorithms allowable under the DICOM specification are not supported by this software.
- Some ACR-NEMA files do not import. Golden Software does not officially support the obsolete ACR-NEMA file formats; however, **Grapher** does import many ACR-NEMA files successfully.

Export Options Dialog

N/A

Export Automation Options

N/A

United States Geologic Survey Digital Line Graph .DLG File Description

Grapherimports USGS digital line graph .DLG files.

The United States Geological Survey (USGS) provides digitized base map data in "line graph" form. It is available in two formats ("standard" and "optional") on either 9-track magnetic tape or CD-ROM. The CD-ROM with 1:2,000,000-scale DLG files contains data in both standard and optional formats, as well as a "graphic" format. The definitive guide to these file formats is the USGS document: "Digital Line Graphs from 1:24,000-Scale Maps: Data Users Guide 1", "Digital Line Graphs from 1:100,000-Scale Maps: Data Users Guide 2" and "Digital Line Graphs from 1:2,000,000-Scale Maps: Data Users Guide 3".

File Information

Imported DLG files are read in the "standard" and "optional" formats, and provides point, area, and curve objects.

For the 1:2,000,000-scale files, the USGS has divided the U.S. into 21 sections. On the CD-ROM, the files associated with each section are stored in a separate subdirectory.

The 21 subdirectories use the following naming convention:

SECT00

Each subdirectory starts with the letters "SECT" followed by the section number (01 to 21). The sections correspond to the following regions:

SECT01	Northeastern States
SECT02	Middle Atlantic States
SECT03	Southeastern States
SECT04	Florida
SECT05	Southern Mississippi Valley States
SECT06	Central Mississippi Valley States
SECT07	Northern Great Lakes States
SECT08	Southern Texas
SECT09	Southern Plains States
SECT10	Central Plains States
SECT11	Northern Plains States
SECT12	Arizona and New Mexico
SECT13	Southern California
SECT14	Central Pacific States
SECT15	Northwestern States
SECT16	Southeastern Alaska
SECT17	Central Alaska
SECT18	Northern Alaska
SECT19	Southwestern Alaska
SECT20	Aleutian Islands
SECT21	Hawaiian Islands

Each section has one or more data files associated with it. The file naming convention used is as follows:

S00_XX.YYY

Each file starts with the letter "S", followed by the section number (01 to 21) and an underscore (_). The XX stands for the feature code (sometimes referred to as Overlay or Base Category). Feature codes are:

PB = Political Boundaries   CF = Cultural Features

AB = Administrative Boundaries   ST = Streams and Rivers

RD = Roads and Trails   WB = Water Bodies

RR = Railroads   HP = Hypsography (Continental Divide Only)

The YYY indicates the data format:

LGS = Line Graph Standard Format

LGO = Line Graph Optional Format

GRF = Graphic Format

If a section has more than one file for a feature, an underscore (_) and a letter are used to uniquely name the files. Examples:

S01_WB_A.LGO

S01_WB_B.LGO

LGO File

An .LGO file contains 15 records of general "header" information, followed by a series of Node, Area and Line entries, in that order. Each Node is assigned a unique ID number (1,2,...). A Node entry contains the node's ID, its coordinate (all coordinates in "optional" format files are in UTM or Albers Equal Area Ellipsoid projection) and the IDs of each line segment that begins at, ends at, or passes through the node. A "free-standing" node is one that has no line segments associated with it (i.e., the node is an isolated point).

Area ID Number

Each Area is assigned a unique ID number (1,2,...) called an area ID. An Area entry contains the area's ID, the coordinate of its "reference point", a list of the IDs of each line segment that forms the area's boundary (including islands and lakes) and a list of attribute codes assigned to the area. An area's reference point is that point on a map where a textual identifier for the area was placed (such as the name of a county).

Line ID Number

Each Line is also assigned a unique ID number (1,2,...). A Line entry contains the line's ID, the Node ID of the node it starts at, the Node ID of the node it ends at, the Area ID of the area to the left of the line, the Area ID of the area to the right of the line, a list of coordinates of the line vertices and a list of attribute codes assigned to the line segment. (Left and right are relative to the line's direction. The line was digitized from the start point to the end point) . A "free-standing" line is one that is not part of an area boundary.

Attribute Codes

Attribute codes are assigned to areas and line segments for the purpose of identifying and/or grouping them. An attribute code consists of two positive integers, a Major code value and a Minor code value. For example, USGS Section 15 contains data for Washington, Oregon, Idaho and part of Montana. In the Political Boundaries file (S15_PB.LGO), each county boundary area contains two attribute codes. One indicates which state the county was associated with (Major code = 91, Minor code = two-digit FIPS code for the state) and the other indicates which county it is (Major code = 92, Minor code = three-digit FIPS code for the county). For a list of attribute codes, see Major and Minor Attributes.

Import Options Dialog

See USGS Digital Line Graph Boundary Import Options Dialog.

Import Automation Options

See USGS Digital Line Graph Boundary Import Automation Options.

Export Options Dialog

Grapher does not currently export .DLG files.

AutoCAD .DXF File Description

AutoCAD .DXF files are ASCII files (i.e., they can be edited with a text editor or word processor) or binary files (cannot be edited) containing records indicating graphical entities and their attributes. They provide a medium of exchange with AutoDesk's **AutoCAD** program. The format of .DXF files is complex and a detailed discussion is beyond the scope of a Help file. Many books describing the .DXF file format are widely available.

Graphics

Graphical information may be stored in the **AutoCAD** Drawing Exchange Format (.DXF). Many programs, including AutoDesk Inc.'s AutoCAD (Computer Aided Design) program can import .DXF files, allowing one to display and/or further manipulate the images. **Grapher** supports MTEXT (multi-line text block) background color in .DXF import filter.

3DSOLID is a proprietary format, and 3DSOLID entities are not supported in **Grapher**. If the .DXF file contains 3DSOLID objects, the 3DSOLID objects will be omitted from the import.

Data

AutoCAD .DXF files can contain point data that includes X, Y, and Z data. DXF files can be opened in a worksheet or used for creating plots. When the DXF file is opened in the worksheet, the X and Y coordinates are displayed in columns A and B. If the DXF file contains Z values, the Z values are displayed in column C. If no Z value is included, column C contains a zero (0).

ASCII or Binary Format

.DXF files can be stored in either ASCII or Binary format. ASCII .DXF files are the most versatile, since they can be displayed, edited, printed and transported to non-IBM machines (such as mainframes, minicomputers or Macintosh). However, they are somewhat bigger and take longer to read back into another application.

Table and Entities Sections

.DXF files have two important sections.

- The *Tables* section contains definitions of the various line styles and other attributes.
- The *Entities* section contains specific information about each graphical entity (line, polygon, etc.) including coordinates and references to the attributes in the defined in the Tables section. All exported graphical entities are assigned to a layer named GSLAYER.

Text

Text can be imported and exported in .DXF files.

Text can be exported as **AutoCAD** text entities (*All text as areas* unchecked). No matter what typeface is specified in the application document, all text entities are assigned **AutoCAD's** STANDARD font. Once inside **AutoCAD**, the text entities can be edited in the normal **AutoCAD** fashion. As long as there is no shear or perspective, .DXF text entities will be sized and oriented similar to the text objects in the application document. Shear occurs when the character glyphs are not perpendicular to the text baseline. Perspective occurs when the height of glyphs in the text string are not all the same, as in a 3D view where the glyphs are smaller the farther they are from the observer.

Line Styles

Lines styles are exported with equivalent **AutoCAD**-compatible line types. The document's internal line styles are assigned the following **AutoCAD** line type names:

Document	**AutoCAD**
Solid	CONTINUOUS
Internal Dash	GSDASHED
Internal Dot	GSDOTTED
Internal Dash-Dot	GSDASHDOT
Internal Dash-Dot-Dot	GSDASHDOTDOT

Custom line styles in the document are assigned AutoCAD line type names of the form GSCUSTOM0, GSCUSTOM1, GSCUSTOM2, etc.

Color Numbers

Indexed .DXF color numbers are assigned to each entity. Color numbers (1,2,3,…,255) are indices into **AutoCAD’s** internal color table. By convention, the first 7 color numbers are guaranteed to have known colors assigned to them by **AutoCAD**. They are:

1	Red
2	Yellow
3	Green
4	Cyan
5	Magenta
7	Black (Default for GSLAYER)

AutoCAD has a default association of colors to color numbers, but the **AutoCAD** user is free to change the colors associated with color numbers 8 through 255. When exporting to .DXF format, the color number of the color from the default **AutoCAD** color table closest to the actual color of the object is assigned to the entity in the .DXF file. Unless you use only the seven colors listed above, the color of objects inside **AutoCAD** may be different than those in the application document.

AutoCAD 2004 and later versions support true colors. When user chooses *AutoCAD 2004*or*AutoCAD 2007 or later* in the **Export Options** dialog, true colors are written to the export file.

Import Options

See AutoCAD .DXF Import Options Dialog

Import Automation Options

See AutoCAD .DXF Import Automation Options

Export Options

See AutoCAD .DXF Export Options Dialog

Export Automation Options

See AutoCAD .DXF Export Automation Options

Esri ArcInfo Export Format .E00 File Description

Esri ArcInfo Export Format .E00 files are ASCII files containing topological entities and their attributes. They provide a medium of exchange between Esri application programs on different hardware and operating system platforms (Windows, UNIX, etc.).

Import Options

See Esri ArcInfo Export Format .E00 Import Options Dialog

Esri ArcInfo Export Format .E00 files can be imported with the **File | Import** command.

Import Automation Options

See Esri ArcInfo Export Format .E00 Import Automation Options

Export

Grapherdoes not currently export .E00 files.

Disclaimer

The E00 file format is not publicly documented by Esri. Although Golden Software has tested this E00 import filter software with a number of publicly available E00 files, it may not be compatible with all E00 files created by all versions of Esri application programs. Golden Software is not affiliated with Esri, and this import filter software is not a product of, nor endorsed by, Esri.

ER Mapper .ECW File Description

Grapher imports ERMapper .ECW files.

Enhanced Compression Wavelet .ECW is an open standard wavelet compression image format developed by Earth Resource Mapping. The file format is optimized for aerial and satellite imagery, and efficiently compresses very large images with fine, alternating contrast. This is a lossy compression format. A region can be specified for import in the .ECW Image Import Options dialog, or the image can be imported as a read-only image. Each of these options decreases the import time for large ECW files.

The .ECW file format has the following properties:

- Embeds map projection information. However **Grapher** does not read map projection information.
- Fast compression (about 1.5 MB of compressed file per second on 1 GHz processor)
- Typical compression ratios between 1:10 and 1:100
- Possible decompression of selected regions without the need to decompress the whole file
- Data flow compression allows for compression of big files with small RAM requirements

Import Options

See .ECW Image Import Options Dialog.

Import Automation Options

See ER Mapper .ECW Import Automation Options.

Export Options

Grapher does not currently support .ECW export.

.EMF Windows Enhanced Metafile File Description

Windows can store graphical objects (i.e. pictures) in a special form called an Windows Enhanced Metafile .EMF file. Such pictures can be stored on disk or in the Windows Clipboard. When these pictures are imported (or pasted from the Clipboard), the objects can be optionally separated and stored individually.

Windows Metafiles are intended to be portable between applications and may contain both vector and image components. In contrast to raster formats such as .JPEG and .GIF which are used to store image (bitmap) graphics such as photographs, scans and graphics, Windows Metafiles generally are used to store line-art, illustrations and content created in drawing or presentation applications. Most Windows clipart is in the .EMF or .WMF format.

Windows Metafile .WMF is a 16-bit format introduced in Windows 3.0. It is the native vector format for Microsoft Office applications such as Word, PowerPoint, and Publisher. A newer 32-bit version with additional commands is called Enhanced Metafile .EMF. .EMF is also used as a graphics language for printer drivers.

Import Options

See Windows Metafile Import Options Dialog.

Import Automation Options

See Windows Enhanced Metafile Import Automation Options.

Export Options Dialog

See Windows Enhanced Metafile Export Options Dialog.

Export Automation Options

See Windows Enhanced Metafile Export Automation Options.

Encapsulated PostScript .EPS File Description

Grapherexports Encapsulated PostScript files .EPS files.

EPS File Format

At a minimum, an EPS file contains a *BoundingBox DSC comment*, describing the rectangle containing the image described by the EPS file.

Identifying EPS files

Because of the different ways in which EPS previews are handled, there is no one way to identify an EPS file.

- A Windows-format EPS file containing a TIFF or WMF preview must start with the four bytes containing, in hexadecimal, C5 D0 D3 C6. Bear in mind these files are widespread on all platforms.
- In all other cases an EPS file must start with a line %!PS-Adobe-a.b EPSF-c.d where a, b, c and d are all single digit numbers.
- A Mac-format EPS file is accompanied by a resource fork. The preview is a PICT resource with ID 256. An EPS file on the Mac is expected to have a file type code of "EPSF", whether or not it has a preview.
- An EPSI file will contain a line starting %%BeginPreview: in the DSC prolog.
- In many cases no preview is present at all.

Import Options Dialog

Grapher does not support .EPS file import.

Export Options Dialog

See Encapsulated PostScript .EPS Export Options Dialog, Size and Color

Export Automation Options

See Encapsulated PostScript Automation Export Options

GeoJSON Data Interchange Format File Description

Grapher imports GeoJSON Data Interchange Format .GEOJSON files. GeoJSON is based on the JavaScript Object Notation and encodes geographic structures. GeoJSON files may include points, polylines, and polygons. GeoJSON uses the World Geodetic System 1984 coordinate system.

For detailed file structure information, see RFC 7946 - The GeoJSON Specification

Loading .GeoJSON Files

GeoJSON files can be loaded with the File | Importcommand.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

No import options are available.

References: *The GeoJSON Specification*. Butler, et al. Published by GeoJSON WG. 2016. www.geojson.org

Graphics Interchange Format .GIF File Description

The Graphics Interchange Format .GIF is an image format that was introduced by CompuServe in 1987 and has since come into widespread usage on the World Wide Web due to its wide support and portability.

File Format

The format supports up to 8 bits per pixel, allowing a single image to reference a palette of up to 256 distinct colors chosen from the 24-bit RGB color space. It also supports animations and allows a separate palette of 256 colors for each frame. The color limitation makes the GIF format unsuitable for reproducing color photographs and other images with continuous color, but it is well-suited for simpler images such as graphics or logos with solid areas of color.

GIF images are compressed using the Lempel-Ziv-Welch (LZW) lossless data compression technique to reduce the file size without degrading the visual quality. This compression technique was patented in 1985. Controversy over the licensing agreement between the patent holder, Unisys, and CompuServe in 1994 inspired the development of the Portable Network Graphics (PNG) standard; since then all the relevant patents have expired.

Usage

- Sharp-edged line art (such as logos) with a limited number of colors. This takes advantage of the format's lossless compression, which favors flat areas of uniform color with well defined edges (in contrast to JPEG, which favors smooth gradients and softer images).
- Used to store low-color sprite data for games.
- Used for small animations and low-resolution film clips.
- In view of the general limitation on the GIF image palette to 256 colors, it is not usually used as a format for digital photography. Digital photographers use image file formats capable of reproducing a greater range of colors, such as TIFF, RAW or the lossy JPEG, which is more suitable for compressing photographs.
- The PNG format is a popular alternative to GIF images since it uses better compression techniques and does not have a limit of 256 colors, but PNGs do not support animations.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

No import options are available.

Export Options Dialog

See Size and Color, GIF Export Options

Export Automation Options

See Image (Bitmap) Export Automation Options

GML Geography Markup Language .GML File Description

Grapher imports GML files with the File | Import command.

File Information

GML files are XML format files defined by the Open Geospatial Consortium. The standards, schemas, and documentation for the GML file format are available from the Open Geospatial Consortium here.

Import Options Dialog

No **Import Options** dialog is displayed.

Import Automation Options

There are no import automation options for this format.

GPX GPS Exchange Format File Format Description

GPS exchange files, .GPX files, are created from GPS devices.

File Structure

GPX files are XML format text files. The .GPX files can contain way points, routes, tracks, and various attribute information. GPX files use the World Geodetic System 1984 coordinate system.

- Way points describe an unrelated group of points. For instance, this can be a collection of place names. Each way point is imported and displayed as the default symbol.
- Routes are a series of connected way points. Typically a route is a plan on where to go. Routes are imported and displayed as polylines. One-point routes are imported and displayed as the default symbol.
- Tracks are a series of connected way points. A track is where the device has actually been. Tracks are imported and displayed as polylines. One-point tracks are imported and displayed as the default symbol.

Remarks

The way points, routes, and tracks in a GPX file are imported into a single group in the plot.

Grapher does not import .GPX files with World Geodetic System 1984 coordinate values. The .GPX file will be displayed with page coordinates in the correct relative positions. **Grapher** does not export .GPX files with World Geodetic System 1984 coordinate values.

Import Options

No import options dialog is displayed.

Import Automation Options

No import automation options exist.

Export Options

No export options exist. The **Export Options** dialog Scaling page is displayed.

Export Automation Options

No export automation options exist.

Loading a GPX

Use the File | Import command to import the GPX file into the plot.

Golden Software Grid .GRD File Description

Grapher imports and exports two-dimensional uniform lattices (elevation grids) in the **Surfer** Grid file format. Both ASCII and binary variants are supported.

Files with the .GRD extension are **Surfer** grid files. To preserve faulting information and to use double precision values in **Grapher**, be sure to save the grid in the Surfer 7 format. If you need to use a grid in **Surfer5** or **Surfer6**, save the grid as GS ASCII .GRD or GS Binary .GRD. Keep in mind that these two formats do not retain fault information or double precision values.

Surfer 6 Text Grid Format

Surfer 6 text grid files .GRD contain five header lines that provide information about the size and limits of the grid, followed by a list of Z values. The fields within ASCII grid files must be space or tab delimited.

The listing of Z values follows the header information in the file. The Z values are stored in row-major order starting with the minimum Y coordinate. The first Z value in the grid file corresponds to the lower left corner of the map. This can also be thought of as the southwest corner of the map, or, more specifically, the grid node of minimum X and minimum Y. The second Z value is the next adjacent grid node in the same row (the same Y coordinate but the next higher X coordinate). When the maximum X value is reached in the row, the list of Z values continues with the next higher row, until all the rows of Z values have been included.

The general format of an ASCII grid file is:

id	The identification string DSAA that identifies the file as an ASCII grid file.
nx	nx is the integer number of grid lines along the X axis (columns) ny is the integer number of grid lines along the Y axis (rows)
xlo	xlo is the minimum X value of the grid xhi is the maximum X value of the grid
ylo	ylo is the minimum Y value of the grid yhi is the maximum Y value of the grid
zlo	zlo is the minimum Z value of the grid. Blanked nodes are not included in the minimum. zhi is the maximum Z value of the grid. Blanked nodes are not included in the maximum. Note that if all nodes are blanked, the zlo-o=zhi= 1.71041e38.

grid row 1
grid row 2
grid row 3
… These are the rows of Z values of the grid, organized in row order. Each row has a constant Y coordinate. Grid row 1 corresponds to ylo and the last grid row corresponds to yhi. Within each row, the Z values are arranged from xlo to xhi. Blank values appear as 1.71041e38.

Example

The following example grid file is ten rows high by ten columns wide. The first five lines of the file contain header information. X ranges from 0 to 9, Y ranges from 0 to 7, and Z ranges from 25 to 97.19. The first Z value shown corresponds to the lower left corner of the map and the following values correspond to the increasing X positions along the bottom row of the grid file. This file has a total of 100 Z values.

```
DSAA
10 10
0.0 9.0
0.0 7.0
25.00 97.19
91.03 77.21 60.55 46.67 52.73 64.05 41.19 54.99 44.30 25.00
96.04 81.10 62.38 48.74 57.50 63.27 48.67 60.81 51.78 33.63
92.10 85.05 65.09 53.01 64.44 65.64 52.53 66.54 59.29 41.33
94.04 85.63 65.56 55.32 73.18 70.88 55.35 76.27 67.20 45.78
97.19 82.00 64.21 61.97 82.99 80.34 58.55 86.28 75.02 48.75
91.36 78.73 64.05 65.60 82.58 81.37 61.16 89.09 81.36 54.87
86.31 77.58 67.71 68.50 73.37 74.84 65.35 95.55 85.92 55.76
80.88 75.56 74.35 72.47 66.93 75.49 86.39 92.10 84.41 55.00
74.77 66.02 70.29 75.16 60.56 65.56 85.07 89.81 74.53 51.69
70.00 54.19 62.27 74.51 55.95 55.42 71.21 74.63 63.14 44.99
```

Surfer 6 Binary Grid File Format

Surfer6 grid files .GRD use a layout similar to the ASCII grid format. The only difference is in the identification string and that **Surfer6** grid files are binary. Data types used in **Surfer6** grid files include:

Type	Description
char	single byte
short	16 bit signed integer
float	32 bit single precision floating point value
double	64 bit double precision floating point value

The **Surfer6** format has the following layout:

Element	Type	Description

id	char	4 byte identification string 'DSBB' which identifies the file as aSurfer6binary grid file.
nx	short	number of grid lines along the X axis (columns)
ny	short	number of grid lines along the Y axis (rows)
xlo	double	minimum X value of the grid
xhi	double	maximum X value of the grid
ylo	double	minimum Y value of the grid
yhi	double	maximum Y value of the grid
zlo	double	minimum Z value of the grid
zhi	double	maximum Z value of the grid
z11, z12, ...	float	first row of the grid. Each row has a constant Y coordinate. The first row corresponds to ylo, and the last row corresponds to yhi. Within each row, the Z values are ordered from xlo to xhi.
z21, z22, ...	float	second row of the grid
z31, z32, ...	float	third row of the grid
...	float	all other rows of the grid up to yhi

Surfer 7 Grid File Format

Surfer7 grid files .GRD use a tag-based binary format to allow for future enhancements. Each section is preceded by a tag structure, which indicates the type and size of the following data. If a program does not understand or want a particular type of data, it can read the associated tag and quickly skip to the next section. In general, sections can appear in any order except for the first, which must be a Header section.

Data types used in **Surfer7** grid files:

Type	**Description**
long	32 bit signed integer
double	64 bit double precision floating point value

Each section is preceded by a tag structure with the following format:

Element	**Type**	**Description**
Id	long	The type of data in the following section. See the next table for a list of valid values.

Size	long	The number of bytes in the section (not including this tag). Skipping this many bytes after reading the tag will align the file pointer on the next tag.

Tag ID Values

Tag Id values. The 0x prefix indicates a hexadecimal value:

Id	Description
0x42525344	*Header* section – must be the first section within the file.
0x44495247	*Grid* section – describes a 2D matrix of Z values.
0x41544144	*Data* section – contains a variable amount of data. The size of the data section is given by the *Size* field in the tag structure.
0x49544c46	*Fault Info* section – describes the fault traces used when creating the grid.

Header Section

The *Header* section must be the first section in the file and has the following format:

Element	Type	Description
Version	long	Version number of the file format. Can be set to 1 or 2

If the version field is 1, then any value >= BlankValue will be blanked using Surfer's blanking value, 1.70141e+038.

If the version field is 2, then any value == BlankValue will be blanked using Surfer's blanking value, 1.70141e+038.

Grid Section

The *Grid* section consists of a header that describes a 2D matrix of values, followed by the matrix itself. This section encapsulates all of the data that was traditionally referred to as a grid:

Element	Type	Description
nRow	long	number of rows in the grid
nCol	long	number of columns in the grid
xLL	double	X coordinate of the lower left corner of the grid
yLL	double	Y coordinate of the lower left corner of the grid
xSize	double	spacing between adjacent nodes in the X direction (between columns)
ySize	double	spacing between adjacent nodes in the Y direction (between rows)
zMin	double	minimum Z value within the grid

zMax	double	maximum Z value within the grid
Rotation	double	not currently used
BlankValue	double	nodes are blanked if greater or equal to this value

Data Section

A *Data* section containing the 2D matrix of values (doubles) must immediately follow a *Grid* section. Within the *Data* section, the grid is stored in row-major order, with the lowest row (minimum Y) first

Fault Info Section

A *Fault Info* section describes the fault geometry used to create the grid. *Fault Info* sections have the following format:

Element	Type	Description
nTraces	long	number of fault traces (polylines)
nVertices	long	total number of vertices in all the traces
data section		variable-sized data block consisting of an array of Trace structures immediately followed by the array of vertices

Data Section

A *Data* section containing an array of *Trace* structures and an array of *Vertex* structures must immediately follow a *Fault Info* section. The number of *Trace* structures in the array is nTraces, and the number ofVertexstructures is

Trace Structure

Trace structure:

Element	Type	Description
iFirst	long	0-based index into the vertex array for the first vertex of this trace
nPts	long	number of vertices in this trace

Vertex Structure

Vertex structure:

Element	Type	Description
x	double	X coordinate of the vertex
y	double	Y coordinate of the vertex

Example

The following example illustrates the layout for a 5 row by 10 column grid:

Element	Type	Description
0x42525344	long	Tag: Id for Header section
4	long	Tag: Size of Header section
1	long	Header Section: Version
0x44495247	long	Tag: ID indicating a grid section
72	long	Tag: Length in bytes of the grid section
5	long	Grid Section: nRow
10	long	Grid Section: nCol
0.0	double	Grid Section: xLL
0.0	double	Grid Section: yLL
1.0	double	Grid Section: xSize
1.75	double	Grid Section: ySize
25.0	double	Grid Section: zMin
101.6	double	Grid Section: zMax
0.0	double	Grid Section: Rotation
1.70141e38	double	Grid Section: BlankValue
0x41544144	long	Tag: ID indicating a data section
400	long	Tag: Length in bytes of the data section (5 rows x 10 columns x 8 bytes per double)
Z11, Z12, …	double	Data Section: First (lowest) row of matrix. 10 doubles
Z21, Z22, …	double	Data Section: Second row of matrix. 10 doubles
Z31, Z32, …	double	Data Section: Third row of matrix. 10 doubles
Z41, Z42, …	double	Data Section: Fourth row of matrix. 10 doubles
Z51, Z52, …	double	Data Section: Fifth row of matrix. 10 doubles

Golden Software Boundary .GSB File Description

Grapherimports and exports Golden Software boundray files .GSB.

The .GSB format is a proprietary[1] Golden Software file format. There are several different versions of GSB files, so older Golden Software applications may not be able to read .GSB files exported from newer applications.

Golden Software Boundary files contain boundary objects including areas, curves and points. Primary and Secondary IDs are usually associated with

[1]not publicly documented

each object. The objects have no attributes (such as color or line style) associated with them.

GS Boundary files are binary files (i.e., they can't be created or modified with a text editor or word processor) that are usually used as base maps. Information indicating the type of projection used (if any) is also stored in the file.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

See Golden Software GSB Import Automation Options

Export Options Dialog

See Golden Software .GSB Export Options

Export Automation Options

See Golden Software .GSB Export Automation Options

Golden Software Interchange .GSI File Description

Golden Software Interchange .GSI files are binary files containing records indicating graphical entities and their attributes. They provide a medium of exchange between Golden Software application programs.

Transparency and Fill

All lines, fills, text, images, and vector objects with transparency are exported and imported with the transparency. Objects with bitmap fills are imported and exported with the fill and transparency. Objects with gradient fill are exported and imported with the gradient fill.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

See Golden Software .GSI Import Automation Options

Export Options Dialog

See Golden Software .GSI Export Options

Export Automation Options

See Golden Software .GSI Export Automation Options

GTopo30 .HDR, .STX, .DEM File Description

Grapher imports elevation data from GTopo30 data sets.

A GTopo30 data set consists of multiple files. The following files must exist in the same directory:

- .HDR contains header information
- .STX the statistics file, used to obtain zmin, zmax
- .DEM contains the actual grid nodes

GTopo30 files are extremely large. **Grapher** can read the files, though approximately 220 MB of RAM is needed for this operation due to the grid size. You can use Grid | Extract to make the file smaller. You must have the associated .DEM, .HDR, and .STX files to use GTopo30 files in **Grapher**. These files are necessary for computing the X, Y, and Z limits. Some GTopo30 files contain a "no data" value of -9999 in the file. The no data value is set to zero elevation in **Grapher**.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

No import options are available.

Loading .HDR Files

GTopo30 .HDR files can be loaded to create a grid based map (i.e. **Contour Grid Map** or **Surface Grid Map**).

Export Options Dialog

Grapher does not currently export GTopo30 data sets.

JPG File Interchange Format .JFIF, .JPG, .JPEG File Description

Grapher imports and exports JPEG JFIF raster image files.

The JPEG File Interchange Format, .JFIF, is a image file format standard. It is a format for exchanging JPEG encoded files compliant with the JPEG Interchange Format .JIF standard. It solves some of JIF's limitations in regard to simple JPEG encoded file interchange. As with all JIF compliant files, image data in JFIF files is compressed using the techniques in the JPEG standard, hence JFIF is sometimes referred to as "JPEG/JFIF".

JFIF defines a number of details that are left unspecified by the JPEG standard (ISO/IEC IS 10918-1, ITU-T Recommendation T.81):

Resolution and aspect ratio

The JPEG standard does not include any method of coding the resolution or aspect ratio of an image. JFIF provides resolution or aspect ratio information using an application segment extension to JPEG. It uses Application Segment #0, with a segment header of 'JFIF\x00', and specifies that this must be the first segment in the file, hence making it simple to recognise a JFIF file. Exif images recorded by digital cameras generally do not include this segment, but typically comply in all other respects with the JFIF standard.

Color Space

JPEG does not define which color encoding is to be used for images. JFIF defines the color model to be used: either Y for greyscale, or YCbCr as defined by CCIR 601. Since this is not an absolute color space — unless an ICC profile, colorspace metadata, or an sRGB tag is provided and interpreted – a decoded JFIF image will be in a device-dependent RGB colorspace. Hence, JFIF does not by itself provide a mechanism for accurately transporting color-managed images across the Internet.

File Format

The JFIF meta data resides in the JPEG Application Segment APP0, having the zero-terminated ASCII string "JFIF" as segment header.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

No import options are available.

Export Options Dialog

See JPEG Export Options Dialog

See Scaling and Spatial References for additional information.

Export Automation Options

See Image Bitmap Export Automation Options for additional information

Legal Notice

This software is based in part on the work of the Independent JPEG Group.

JP2 JPG 2000 File Interchange Format .JP2, J2K, .JPC, .JPT, .JPEG2000, .J2000 File Description

Grapher imports and exports JP2 JPEG 2000 raster image files. The JPEG 2000 File Interchange Format, .JP2, is a image file format standard with additional wavelet compression techniques. It is a format for exchanging JP2 encoded files compliant with the JPEG Interchange Format standard. This format is based on the ISO standard (ISO 15444/6). JPEG2000 offers both losssless and lossy compression and creates smaller file sizes than JPG exports. The image is also better quality than the traditional JPG format.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

No import options are available.

Export Options Dialog

See Size and Color, JPEG-2000 Options

Export Automation Options

See Bitmap Export Automation Options for additional information.

LAS LiDAR Binary (.LAS, .LAZ) File Description

The ASPRS LiDAR LAS binary file format stores 3D point data. LiDAR stands for Light Detection and Ranging data. This data is generally created by software which combines GPS, IMU, and laser pulse range data to produce X, Y, and Z point data. To use binary LiDAR data, click File | Open and select the LAS file or click File | Import in the worksheet window.

Grapher imports compressed (.LAZ) and uncompressed LAS LiDAR binary files.

File Format

The format contains binary data consisting of a header block, variable length records, and point data. All data is in little-endian format. The header block consists of a public block followed by variable length records. The public block contains generic data such as point numbers and coordinate bounds. The variable length records contain variable types of data including projection information, metadata, and user application data.

Currently, **Grapher** imports 1.0, 1.1, 1.2, and 1.3 format LAS files. These can contain up to 32 codes.

Classification Number	Meaning
0	Created, never classified
1	Unclassified
2	Ground
3	Low Vegetation
4	Medium Vegetation
5	High Vegetation
6	Building
7	Low Point (noise)
8	Model Key-point
9	Water
10	Rail
11	Road Surface
12	Reserved
13	Wire - Guard (Shield)
14	Wire - Conductor (Phase)
15	Transmission Tower
16	Wire - Structure Connector (e.g. Insulator)
17	Bridge Deck
18	High Noise
19-32	Reserved

Import Options Dialog
See LiDAR Import Filtering Dialog

Import Automation Options
See LiDAR Import Automation Options

MapInfo Interchange Format .MIF File Description

MapInfo Interchange Format .MIF files contain boundary objects including areas, curves and points. The objects optionally have attributes (such as color or line style) associated with them.

.MIF files are text files that are usually used as base maps. They can be imported using the **File | Import**command.

MID File
Each. MIF file is usually accompanied by a file with the same name, but with the .MID filename extension. The .MID file contains attribute information about the objects in the map. This information is imported in the objects' Primary ID and Secondary ID. The .MID file can be opened in the worksheet with the File | Open command.

Import Options Dialog
No import options dialog is displayed.

Import Automation Options
See MapInfo Interchange Format (MIF) Import Automation Options

Export Options Dialog
See MapInfo Interchange Format (MIF) Export Options Dialog

Export Automation Options
See MapInfo Interchange Format (MIF) Export Automation Options

Adobe Portable Document Format .PDF File Description
Portable Document Format .PDF is a file format used for document exchange. PDF is used for representing two-dimensional documents. PDF

was created by Adobe Systems. PDF files can be imported and exported. PDF files can also be printed to a PDF printer.

File Structure

A .PDF file consists primarily of eight object types.

- *Boolean* values, representing true or false
- Numbers
- Strings
- Names
- *Arrays*, ordered collections of objects
- *Dictionaries*, collections of objects indexed by *Names*
- *Streams*, usually containing large amounts of data
- The *Null* object

Import Options Dialog

See PDF Import Options Dialog

Import Automation Options

See PDF Adobe Import Automation Options

Export Options Dialog

Use the **File | Export** command to export as a PDF (Raster) (*.PDF) file or a PDF (Vector) (*.PDF) file. Alternately, you can use the **File | Print** command to print to a PDF driver if you have one installed.

Export Automation Options

See Bitmap Export Automation Options for raster PDF file export or PDF Vector Export Automation Options for additional information.

Portable Network Graphic .PNG File Description

Grapherimports and exports Portable Network Graphic .PNG files.

Portable Network Graphics .PNG is an image format that employs lossless data compression. PNG was created to improve upon and replace GIF (Graphics Interchange Format) as an image-file format not requiring a patent license.

PNG supports palette-based, greyscale, or RGB images. PNG does not support CMYK color spaces.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

See Bitmap Import Automation Options

Export Options Dialog

See Size and Color, PNG Export Options

Export Automation Options

See Bitmap Export Automation Options

Portable Any Map .PNM File Description

Grapher imports Portable Any Map .PNM, Portable Pixel Map .PPM, Portable Gray Map .PGM, and Portable Bitmap .PBM files. **Grapher** exports .PNM files.

Although there are both binary and ASCII variants of this file format, the current version of the filter always writes binary files when exporting.

The portable pixmap file format .PPM, the portable graymap file format .PGM and the portable bitmap file format .PBM specify rules for exchanging graphics files. They provide very basic functionality and serve as a least-common-denominator for converting pixmap, graymap, or image files between different platforms. Several applications refer to them collectively as the PNM format (portable anymap).

The .PGM and .PPM formats (both ASCII and binary versions) have an additional parameter for the maximum value in a line between the X and Y dimensions and the actual pixel data.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

See Bitmap Import Automation Options

Export Options Dialog

See Size and Color

Export Automation Options
See Bitmap Export Automation Options

Golden Software PlotCall .PLT File Description

Graphercan import Golden Software PlotCall .PLT files.

PlotCall files .PLT contain line graphics designed to be output on pen plotters. The curve, point and text objects of a PlotCall file are imported into **Grapher** with the **File | Import** command. There is no capability to export PlotCall files.

In the PlotCall file, each pen used is assigned a number. There can be up to 16 pens used in a PlotCall file.

PlotCall files can be either ASCII files (i.e., they can be edited with a text editor or word processor) or binary files (can't be edited) containing commands. Each command occupies one record and begins with a two-letter operation code (op-code) to determine its function. The currently supported op-codes are:

Op-code	**Function**
MA	Move Absolute
PA	Plot Absolute
TR	Translate
SC	Scale
PS	Plot String
SS	Set Symbol Set
RO	Rotate
PI	Pivot
SP	Select Pen

The general format of most commands is "op-code X,Y" where X and Y are coordinate values measured in inches. See Golden Software's PlotCall manual for a detailed description of each command. PlotCall files are usually produced by Golden Software's DOS applications, or by special user-written programs on PCs or mainframes.

Import Options Dialog

No import option dialog is displayed.

Import Automation Options

Golden Software PlotCall Automation Options

Export Options Dialog

Grapher does not export .PLT files.

Stanford Polygon .PLY File Description

PLY is a computer file format known as the *Polygon File Format* or the *Stanford Triangle Format*. The format was designed to store three dimensional data from 3D scanners. It supports a relatively simple description of a single object as a list of nominally flat polygons. A variety of properties can be stored including: color and transparency, surface normals, texture coordinates and data confidence values. The format permits one to have different properties for the front and back of a polygon.

File Format

Files are organized as a header, that specifies the elements of a mesh and their types, followed by the list of elements itself, usually vertices and faces eventually other entities such as edges, samples of range maps, and triangle strips can be encountered.

The header of both ASCII and binary files is ASCII text. Only the numerical data that follows the header is different between the two versions. The header always starts with the line 'ply'. The header helps to identify this as a genuine 'PLY' file.

```
ply
```

The second line indicates which variation of the PLY format this is. It should be one of:

```
format ascii 1.0
format binary_little_endian 1.0
format binary_big_endian 1.0
```

Future versions of the standard will change the revision number at the end - but 1.0 is the only version currently in use.

Comments may be placed in the header by using the word 'comment' at the start of the line. Everything from there until the end of the line should then be ignored. eg:

comment This is a comment!

The 'element' keyword introduces a description of how some particular data element is stored and how many of them there are. Hence, in a file where there are 12 vertices, each represented as a floating point (X,Y,Z) triple, one would expect to see:

element vertex 12
property float x
property float y
property float z

Other 'property' lines might indicate that colours or other data items are stored at each vertex and indicate the data type of that information. Regarding the data type there are two variants, depending on the source of the ply file, the type can be specified with one of *char uchar short ushort int uint float double*, or one of *int8 uint8 int16 uint16 int32 uint32 float32 float64*. For an object with ten polygonal faces, one might see:

element face 10
property list uchar int vertex_index

The word 'list' indicates that the data is a list of values - the first of which is the number of entries in the list (represented as a 'uchar' in this case) and each list entry is (in this case) represented as an 'int'.

At the end of the header, there must always be the line:

end_header

In the ASCII version of the format, the vertices and faces are each described one to a line with the numbers separated by white space. In the binary version, the data is simply packed closely together at the 'endianness' specified in the header and with the data types given in the 'property' records. For the common "property list..." representation for polygons, the first number for that element is the number of vertices that the polygon has and the remaining numbers are the indices of those vertices in the preceding vertex list.

Import

Stanford Polygon (.PLY) files can be imported into **Grapher**. The geometry (shape) information from PLY models is the only item imported. Any surface/material properties of the PLY model are ignored. No import options dialog is displayed.

Import Automation Options

No import options are available.

Export Options Dialog

Grapher does not currently support exporting .PLY files.

Reference

This implementation is based on the file format described in Greg Turk's 1998 "The PLY Polygon File Format" document, which can be found on the Internet.

Sun Raster Image .RAS, .SUN File Description

Grapher imports and exports Sun Raster .RAS and .SUN image files.

The Sun Raster .RAS and .SUN file format originated at Sun Microsystems and is a common file format for storing bitmap images on UNIX and Solaris workstations.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

See Bitmap Import Automation Options

Export Options Dialog

See Size and Color

Export Automation Options

See Bitmap Export Automation Options

Silicon Graphics .RGB Image File Description

Grapher imports and exports Silicon Graphics Image .RGB, .RGBA, and .BW files.

This file format .RGB, .RGBA, .BW originated on Silicon Graphics workstations and is/was used in a variety of high-end imaging applications, both Unix- and Windows-based. The filename extension is sometimes used to indicate the format of the image contained in the file, but is not required to do so. The extensions are typically .BW for black and white images, .RGB for 24-bit color images, and .RGBA for 32-bit color images with an alpha channel.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

See Bitmap Import Automation Options

Export Options Dialog

See Size and Color

Export Automation Options

See Bitmap Export Automation Options

TIGER/Line File RT* File Description

Grapher can import TIGER/Line .RT* files. A TIGER/Line file dataset usually includes many .RT* files in a single directory. TIGER/Line files are extracts of selected geographic and cartographic information from the Census TIGER® database. TIGER/Line vector files include point, polyline, and polygon features that represent land attributes and political or statistical areas, such as boundaries, census tracts, roads, cities, rivers, etc. TIGER/Line files contain only geographic information, but can be linked to United States Census Bureau demographic data for analysis.

The TIGER/Line file format is a text-based format. The TIGER/Line file format was replaced by a shapefile specification in 2008.

Importing TIGER/Line Files

Import features from TIGER/Line files with the File | Import command. Select any TIGER/Line .RT* file in the **Import** dialog to load the dataset.

Import Options Dialog
There are no TIGER/Line .RT* import options.

Import Automation Options
There are no TIGER/Line .RT* import automation options.

References: *2002 TIGER/Line Technical Documentation*, prepared by the U.S. Census Bureau, 2003. www.census.gov.

.SP1 SEG Standard Data Exchange File Description

The .SP1 SEG standard data exchange file format is a format widely used in the geophysical industry to exchange data for shotpoint locations for seismic surveying. **Grapher** currently imports and exports version SP1 file formats. Shotpoint locations are usually those computed locations which are the best estimates of where actual data points are located in the field. The locations are derived from a variety of complex field data. This format is applicable for both land and marine locations and has sufficient flexibility for use in 3D seismic surveys. This can include gravity, magnetic data, or other data about each shotpoint. For additional information on specifics about each file format, refer to the Society for Exploration Geophysicists.

SP1 files can be opened by clicking the File | Open command or by clicking the File | Import command in a worksheet window. Alternatively, the SP1 format can be used to create plots in the plot window. When importing into **Grapher**, the line name, shotpoint number, and non-zero Z value is imported and displayed in attribute columns for each point.

The SEG and SP1 file formats are fairly flexible and can include data in latitude and longitude or in easting, northing, and depth/elevation formats. When loading latitude/longitude data, the WGS84 datum is assumed.

Import Options Dialog
See SEG SP1 Import Options

Export Options Dialog
See Scaling page

Export Automation Options
See SEG SP1 Export Automation Options

Esri Shapefile .SHP File Description

Esri Shapefiles are typically usually used in **Grapher** as drawings. They can be imported using the **File | Import** command.

Esri Shapefiles are in a binary file format (i.e., they can't be created or modified with a text editor or word processor) that is compatible with Arc/Info, Arc/View, and other Esri application programs. This format is used to store spatial information including boundary objects such as areas, curves, and points. Spatial information is only concerned with the location of objects in space (i.e., their coordinates) and not with their attributes (such as line or fill style, marker symbol used, text labels, etc.).

Three types of files are produced with each export:

Filename Extension	**Description**
.SHP	Contains the coordinates of each object in the drawing.
.SHX	Contains the file offset of each object in the .SHP file.
.DBF	Contains the attribute text associated with each object in the .SHP file.

In each of the .SHP, .SHX, and .DBF files, the shapes in each file correspond to each other in sequence. That is, the first record in the .SHP file corresponds to the first record in the .SHX and .DBF files, and so on. The .SHP and .SHX files have various fields with different endianness, so as an implementor of the file formats you must be very careful to respect the endianness of each field and treat it properly.

Overview

A shapefile is a digital vector storage format for storing geometric location and associated attribute information. This format lacks the capacity to store topological information. The shapefile format was introduced with ArcView GIS version 2 in the beginning of the 1990s. It is now possible to read and write shapefiles using a variety of free and non-free programs.

Shapefiles are simple because they store primitive geometrical data types of points, lines, and polygons. These primitives are of limited use without any attributes to specify what they represent. Therefore, a table of records will store properties/attributes for each primitive shape in the shapefile. Shapes (points/lines/polygons) together with data attributes can create infinitely many representations about geographical data.

Representation provides the ability for powerful and accurate computations.

While the term "shapefile" is quite common, a "shapefile" is actually a set of several files. Three individual files are normally mandatory to store the core data that comprises a shapefile. There are a further eight optional files which store primarily index data to improve performance. Each individual file should conform to the MS DOS 8.3 filenameing convention (8 character filename prefix, fullstop, 3 character filename suffix such as shapefil.shp) in order to be compatible with past applications that handle shapefiles. For this same reason, all files should be located in the same folder.

Shapefiles deal with coordinates in terms of X and Y, although they are often storing longitude and latitude, respectively. While working with the X and Y terms, be sure to respect the order of the terms (longitude is stored in X, latitude in Y).

Mandatory files

.SHP - shape format; the feature geometry itself

.SHX - shape index format; a positional index of the feature geometry to allow seeking forwards and backwards quickly

.DBF - attribute format; columnar attributes for each shape, in dBase III format

Optional files

.PRJ - projection format; the coordinate system and projection information, a plain text file describing the projection using well-known text format

.SBN and .SBX - a spatial index of the features

.FBN and .FBX - a spatial index of the features for shapefiles that are read-only

.AIN and .AIH - an attribute index of the active fields in a table or a theme's attribute table

.IXS - a geocoding index for read-write shapefiles

.MXS - a geocoding index for read-write shapefiles (ODB format)

.ATX - an attribute index for the .dbf file in the form of shapefile.columnname.atx (ArcGIS 8 and later)

.SHP.XML- metadata in XML format

Shapefile shape format .SHP

The main file .SHP contains the primary geographic reference data in the shapefile. The file consists of a single fixed length header followed by one or more variable length records. Each of the variable length records includes a record header component and a record contents component. A detailed description of the file format is given in the Esri Shapefile Technical Description.1 This format should not be confused with the AutoCAD shape font source format, which shares the .shp extension.

The main file header is fixed at 100 bytes in length and contains 17 fields; nine 4-byte (32-bit signed integer or int32) integer fields followed by eight 8-byte (double) signed floating point fields:

Bytes	Type	Endianness	Usage
0-3	int32	big	File code (always hex value 0x0000270a)
4-23	int32	big	Unused; five uint32
24-27	int32	big	File length (in 16-bit words, including the header)
28-31	int32	little	Version
32-35	int32	little	Shape type (see reference below)
36-67	double	little	Minimum bounding rectangle (MBR) of all shapes contained within the shapefile; four doubles in the following order: min X, min Y, max X, max Y
68-83	double	little	Range of Z; two doubles in the following order: min Z, max Z
84-99	double	little	Range of M; two doubles in the following order: min M, max M

The file then contains any number of variable-length records. Each record is prefixed with a record-header of 8 bytes:

Bytes	Type	Endianness	Usage
0-3	int32	big	Record number
4-7	int32	big	Record length (in 16-bit words)

Following the record header is the actual record:

Bytes	Type	Endianness	Usage
0-3	int32	big	Shape type (see reference below)
4-	-	-	Shape content

The variable length record contents depend on the shape type. The following are the possible shape types:

Value	Shape Type	Fields
0	Null shape	None
1	Point	X, Y
3	Polyline	MBR, Number of parts, Number of points, Parts, Points
5	Polygon	MBR, Number of parts, Number of points, Parts, Points
8	MultiPoint	MBR, Number of points, Points
11	PointZ	X, Y, Z, M
13	PolylineZ	*Mandatory*: MBR, Number of parts, Number of points, Parts, Points, Z range, Z array *Optional*: M range, M array
15	PolygonZ	*Mandatory*: MBR, Number of parts, Number of points, Parts, Points, Z range, Z array *Optional*: M range, M array
18	MultiPointZ	*Mandatory*: MBR, Number of points, Points, Z range, Z array *Optional*: M range, M array
21	PointM	X, Y, M
23	PolylineM	*Mandatory*: MBR, Number of parts, Number of points, Parts, Points *Optional*: M range, M array
25	PolygonM	*Mandatory*: MBR, Number of parts, Number of points, Parts, Points *Optional*: M range, M array
28	MultiPointM	*Mandatory*: MBR, Number of points, Points *OptionalFields*: M range, M array
31	MultiPatch	*Mandatory*: MBR, Number of parts, Number of points, Parts, Part types, Points, Z range, Z array *Optional*: M range, M array

In common use, shapefiles containing Point, Polyline, and Polygon are extremely popular. The "Z" types are three-dimensional. The "M" types contain a user-defined measurement which coincides with the point being referenced. Three-dimensional shapefiles are rather uncommon, and the measurement functionality has been largely superseded by more robust databases used in conjunction with the shapefile data.

Shapefile shape index format (.shx)

The shapefile index contains the same 100-byte header as the .SHP file, followed by any number of 8-byte fixed-length records which consist of the following two fields:

Bytes	Type	Endianness	Usage
0-3	int32	big	Record offset (in 16-bit words)
4-7	int32	big	Record offset (in 16-bit words)

Using this index, it is possible to seek backwards in the shapefile by seeking backwards first in the shape index (which is possible because it uses fixed-length records), reading the record offset, and using that to seek to the correct position in the .SHP file. It is also possible to seek forwards an arbitrary number of records by using the same method.

Shapefile attribute format .DBF

Attributes for each shape are stored in the xBase (dBase) format, which has an open specification.

Shapefile projection format .PRJ

The projection information contained in the .PRJ file is critical in order to understand the data contained in the .SHP file correctly. Although it is technically optional, it is most often provided, as it is not necessarily possible to guess the projection of any given points. The file is stored in well-known text (WKT) format.

Some typical information contained in the .PRJ file is:

- Geographic coordinate system
- Datum (geodesy)
- Spheroid
- Prime meridian
- Map projection
- Units used
- Parameters necessary to use the map projection, for example:
- Latitude of origin
- Scale factor
- Central meridian
- False northing

- False easting
- Standard parallels

Shapefile spatial index format (.sbn)

This is a binary spatial index file, which is used only by Esri software. The format is not documented, and is not implemented by other vendors. The .SBN file is not strictly necessary, since the .SHP file contains all of the information necessary to successfully parse the spatial data.

Limitations

Topology and shapefiles

Shapefiles do not have the ability to store topological information. ArcInfo coverages and Personal/File/Enterprise Geodatabases do have the ability to store feature topology.

Spatial representation

The edges of a polyline or polygon are defined using points, which can give it a jagged edge at higher resolutions. Additional points are required to give smooth shapes, which requires storing quite a lot of data compared to, for example, bézier curves, which can capture complexity using smooth curves, without using as many points. Currently, none of the shapefile types support bézier curves.

Data storage

Unlike most databases, the database format is based on older xBASE standard, incapable of storing null values in its fields. This limitation can make the storage of data in the attributes less flexible. In ArcGIS products, values that should be null are instead replaced with a 0 (without warning), which can make the data misleading. This problem is addressed in ArcGIS products by using Esri's Personal Geodatabase offerings, one of which is based on Microsoft Access.

Mixing shape types

Each shape file can technically store a mix of different shape types, as the shape type precedes each record, but common use of the specification dictates that only shapes of a single type can be in a single file. For example, a shape file cannot contain both Polyline and Polygon data. Thus, well (point), river (polyline) and lake (polygon) data must be kept in three separate files.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

See Esri Shapefile Import Automation Options

Export Options Dialog

See Esri Shapefile Export Options Dialog and Scaling

Export Automation Options

See Esri Shapefile Export Automation Options

LizardTech MrSID .SID File Description

The MrSID (pronounced Mister Sid) is an acronym that stands for *multiresolution seamless image database*. It is a file format developed and patented by LizardTech for encoding of georeferenced raster graphics.

Import Options Dialog

See MrSID Import Options Dialog.

Import Automation Options

See MrSID Import Automation Options.

Export Options

Grapher does not currently have the ability to export MrSID .SID files.

Third Party Notice

.SVG Scalable Vector Graphics File Description

SVG files are an XML based vector image format designed for use with two-dimensional graphics. SVG files can contain raster graphics, vector polylines and polygons, and text. When exported from Golden Software programs, SVG files contain text that is drawn as vector polylines and polygons. Objects are typically grouped in the .SVG file.

SVG is an open standard available for import and export from many programs. SVG is intended to be portable between applications. The SVG file format is maintained by the W3C SVG Working Group.

Import Options
Grapherdoes not currently import this file format.

Export Options Dialog
See Export Options - Scaling Page

Export Automation Options
See SVG Export Automation Options

SYLK SLK Files

Microsoft SYLK .SLK files contain data and worksheet formatting information, except for background color. When SYLK files are imported to the worksheet, the data format is based on the information in the file. If the data has fixed formatting with four decimal digits, the data are displayed in this manner when the .SLK file is loaded into the worksheet.

If a SYLK file is created in another application and loaded into the worksheet, there might be special formatting information in the file that the worksheet cannot use. In these cases, the data file is loaded without the special formatting, but if the file is saved in a SYLK format in the worksheet the special formatting information is lost.

Technically, the SYLK specification has a 65,536 row limit and a 256 column limit. However, SYLK is an ASCII format so it is possible to have an unlimited size. The Golden Software SYLK Import and Export filters allow limits greater than the specifications indicate, so larger worksheets can be saved in SYLK format. However, other spreadsheet programs may not be able to load these large SYLK files.

Import Options Dialog
No import options dialog is displayed.

Import Automation Options
No import options are available.

Loading .SLK Files
.SLK files can be loaded with the **File | Open** command.

Export Options Dialog

No export options dialog is displayed.

Export Automation Options

No export options are available.

Saving .SLK Files

.SLK files can be saved from a worksheet using the **File | Save As** command.

MapInfo Table .TAB File Description

Grapher imports MapInfo Table TAB vector map files. MapInfo Table TAB files define a table structure. When combined with the appropriate .MAP, .ID, and .DAT files, MapInfo TAB files can include geographic features such as points, lines, polgyons, and text with attributes. The associated .MAP, .ID, and .DAT files must be in the same directory as the .TAB file to import the vector .TAB file.

File Structure

MapInfo TAB text files are the main file for a MapInfo table and include the table structure. MapInfo DAT binary files include attribute data. MapInfo MAP binary files store the geographic objects. MapInfo ID files link the geographic objects to graphic data.

Loading MapInfo TAB files

TAB vector map files can be loaded with the File | Import command. The directory must also include the .MAP, .ID, and .DAT associated files.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

No import options are available.

References:

MapInfo Dataset Format. Library of Congress. www.loc.gov

MapInfo TAB and MIF/MID. Geospatial Data Abstraction Library. www.gdal.org

Truevision Targa .TGA File Description

TARGA is an acronym for Truevision Advanced Raster Graphics Adapter; TGA is an initialism for Truevision Graphics Adapter. Today, most people refer to the format as the "TARGA File Format".

File Format

Truevision's (now AVID) TGA file format, often referred to as TARGA file format, is a raster graphics file format. It was the native format of Truevision Inc.'s TARGA and VISTA boards, which were the first graphic cards for IBM-compatible PCs to support Highcolor/truecolor display. This family of graphic cards was intended for professional computer image synthesis and video editing with PCs; for this reason, usual resolutions of TGA image files match those of the NTSC and PAL video formats.

TGA files commonly have the extension .TGA on PC DOS/Windows systems. The format can store image data with 8, 16, 24, or 32 bits of precision per pixel, the maximum 24 bits of RGB and an extra 8-bit alpha channel. Color data can be color-mapped, or in direct color or truecolor format; optionally, a lossless PackBits RLE compression can be employed.

Uncompressed 24-bit TGA images are relatively simple compared to several other prominent 24-bit storage formats: A 24-bit TGA contains only an 18-byte header followed by the image data as packed RGB data. In contrast, BMP requires padding rows to 4-byte boundaries, TIFF and PNG are metadata containers that do not place the image data or attributes at a fixed location within the file.

Import Options

No import options dialog is displayed.

Import Automation Options

See Bitmap Import Automation Options

Export Options

See Size and Color

Export Automation Options

See Bitmap Export Automation Options

Tagged Image File Format .TIF File Description

The tagged image file format .TIF or .TIFF is a file format for storing images, including photographs and line art. The TIFF format is widely supported by a variety of applications.

Grapher can import and export .TIF and .TIFF files.

The TIFF specification allows an unusually wide variety of different formats and encodings within the same file format. While the filter can read most of the common variants of TIFF, it would be impractical to develop software to read every possible variant. The TIFF filter supports a wide variety of TIFF files that use the PlanarConfiguration 2 encodings and also supports the encoding described in *Adobe Photoshop TIFF Technical Note 3*.

The TIFF filter supports importing BigTIFF format files. BigTIFF is an variant of the TIFF file format that can be used to save TIFF files larger than 2GB.

TIFF images that contain bit per pixel counts other than 1, 4, 8, 16, 24, or 32 may not be readable depending on the encoding and alignment of the data.

TIFF images that are encoded with photometric interpretation models other than RGB, grayscale, or monochrome may not be readable. In particular, some YUV encodings cannot be imported.

Some of the compression algorithms allowable under the TIFF specification are not supported by **Grapher**.

TIFF raster data files can be imported and displayed as images in **Grapher** or used as data files for contour and surface maps.

Import Options

No import options dialog is displayed when importing the TIFF file as an image.

When opening a TIFF file as a grid with the **Open Grid** dialog or when importing a raster data TIFF as an image, the TIFF Import Options dialog is displayed.

Import Automation Options

See Bitmap Import Automation Options when importing a TIFF as an image.

See TIF Tagged Image File Import Automation Options when importing the TIFF as a grid file.

Export Options

See Size and Color and TIFF Export Options

Export Automation Options

See Bitmap Export Automation Options

Idrisi Binary Vector .VCT File Description

Grapher imports the Idrisi Binary Vector .VCT format. VCT files are paired with documentation files (.VDC). Sometimes there is also an associated .REF file. Each IDRISI Binary Vector .VCT file includes only one feature type: point, polyline, polygon, or text. Each feature is described by a single numeric attribute and one or more XY coordinate pairs.

For detailed file structure information, download the TerrSet Help System from Clark Labs.

Loading .VCT Files

Idrisi Vector VCT files can be imported with the File | Import command.

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

No import options are available.

References: *TerrSet Manual*. Published by Clark Labs, Clark University. www.clarklabs.org

Visual Tool Kit .VTK File Description

Grapher can import Visualization Tool Kit .VTK data sets. This implementation is based on version 4.2 of the VTK File Format documentation from Kitware.

VTK data sets can contain several types of lattice data and/or geometric figures. The content of VTK files can be in ASCII text format or a mixed binary/ASCII format in which headers and parameters are in ASCII format but the data values are in binary format.

File name extension: .VTK

Format(s) Supported for Import

- 3D uniform lattice; 8-, 16-, 32-bit integer, float, double
- point set; double

Format(s) Supported for Export

3D uniform lattice; 8-, 16-, 32-bit integer, float, double

Import Options

No import options dialog is displayed.

Import Automation Options

No import options are available.

Export Options

Grapher does not export VTK files.

Import Restrictions/Limitations

The implementation of the software does not directly support geometric figures in VTK data sets. Geometric figures are currently imported as **Grapher** point sets, with one point at each vertex in the geometric model.

.WMF Windows Metafile File Description

Windows stores graphical objects (i.e., pictures) in a special form called a metafile. Such pictures can be stored on disk or in the Windows Clipboard. When these pictures are imported (or pasted from the Clipboard), the objects can be optionally separated and stored individually.

Windows Metafiles are intended to be portable between applications and may contain both vector and image components. In contrast to raster formats such as .JPEG and .GIF which are used to store image (bitmap) graphics such as photographs, scans and graphics, Windows Metafiles generally are used to store line-art, illustrations and content created in drawing or presentation applications. Most Windows clipart is in the .WMF or .EMF format.

Windows Metafile .WMF is a 16-bit format introduced in Windows 3.0. It is the native vector format for Microsoft Office applications such as Word, PowerPoint, and Publisher. A newer 32-bit version with additional commands is called Enhanced Metafile (EMF). EMF is also used as a graphics language for printer drivers.

The Windows metafile formats are Windows Clipboard (Picture) .CLP, Windows Metafile (Enhanced) .EMF, and Windows Metafile .WMF.

Import Options

See Windows Metafile Import Options Dialog.

Import Automation Options

See Windows Metafile Import Automation Options.

Export Options Dialog

See Windows Metafile Export Options Dialog.

Export Automation Options

See Windows Metafile Export Automation Options.

AVS X-Image [.XIMG] File Description

Grapher can import and export AVS X-Image .X and .XIMG files.

The AVS X-Image format originated on UNIX workstations and is typically used to store true-color images containing an alpha channel, a feature that most other image file formats lacked at the time this file format was developed. An AVS X-Image file is a binary file containing a raster image with 8-bits each for the red, green, blue, and alpha channels (32 bits total per pixel).

Import Options Dialog

No import options dialog is displayed.

Import Automation Options

No import options are available.

Export Options Dialog

See Size and Color

Export Automation Options

See Image Bitmap Export Automation Options

Excel Files

Microsoft Excel .XLS, .XLSX files contain data and retain some cell formatting in **Grapher**. Some information, such as formulas, is ignored. Excel files can preserve all formatting information available in the Golden Software worksheet. **Grapher** can import multiple sheets from an Excel file simultaneously.

Grapher supports the import of .XLS, .XLSX, and .XLSM Excel files. **Grapher** supports the export of .XLS and .XLSX files.

Excel .XLS

Excel .XLS files are Microsoft Excel documents. Worksheet cell data and some cell formatting are retained with this format. Other types of information, such as formulas, are ignored.

Excel .XLS format files can preserve all formatting information available in the Golden Software worksheet. This format has a 65,536-row limit and a 256-column limit in Excel 97 and greater. Therefore, this format cannot be used to store very large data sets.

Excel .XLSX

Excel .XLSX files are Microsoft Excel 2007/2010 XML spreadsheets. Worksheet cell data and some cell formatting are retained with this format. Other types of information, such as formulas, are ignored.

Excel .XLSX format files can preserve all formatting information available in the Golden Software worksheet. This format has a 1,048,576-row limit and a 16,384-column limit in Excel 2007 and greater.

Excel .XLSM

Excel .XLSM files are Microsoft Excel 2007/2010 XML spreadsheets. XLSM files can contain macros and VBA scripts. Worksheet cell data and some cell formatting are retained with this format. Other types of information, such as formulas, are ignored.

Excel .XLSM format files are not saved in **Grapher**.

Use Caution when Saving Excel Files!

Use theFile | Save To Multi-Sheet Excel Filecommand to save multiple worksheets in a single Excel document.

A file can be saved in an Excel format from **Grapher** worksheet, ***but only one worksheet can be saved*** when using the File | Save or File | Save As command. If a multi-worksheet Excel file is opened and saved as an .XLS or .XLSX file from the **Grapher** worksheet, be aware that only the single worksheet is saved in the document. If the existing file is over-written, all the unused worksheets are destroyed. In this case, a warning message is issued. The message reads: *Saving this worksheet will des-troy all but one of the sheets in the existing *.xls, *.xlsx file. To overwrite the file, click OK. To choose a different file name, click Cancel.*

Special Characters Used in Excel Files

There are a number of special characters that can be contained in an Excel file that the worksheet cannot handle in the same way as Excel. For these characters, **Grapher** substitutes a reasonable representation so the value displayed in the cell looks similar to what was displayed in Excel.

Font Color in Excel Files

Font color is maintained when opening XLSX and XLSM files in the work-sheet. However XLS files are opened with black font, regardless of font color in the XLS file.

Retaining Excel Information

To save all the formatting, formulas, and worksheets in an .XLS, .XLSX file, you can use Excel directly in **Grapher**. Use File | Open Excel to utilize all of Excel's features, save multi-sheet files, and create graphs in **Grapher**.

Import Options Dialog

See Excel Import Options Dialog

Import Automation Options

See Import Automation Options String.

Export Options

See Excel Export Options Dialog.

Export Automation Options

See Export Automation Options

XYZ Points [.CSV, .DAT, .TXT, .XYZ] File Description

Grapher plots can be exported to a .DAT or .CSV data file that includes XYZ coordinates and attribute values. The XYZ Points file is an ASCII/ANSI text file containing one or more records, where each record occupies one line of text. Each record corresponds to a single point in the exported plot. Multi-point objects (such as polylines and polygons) are represented by multiple records in the file with one record for each vertex in the polyline/polygon.

The XYZ Points format is a vector format. 3D and contour graph types should not be exported to XYZ Points files since these graph types are images.

Each record begins with the point's X, Y, and Z coordinates, separated by commas and followed by attributes. Exporting a CSV XYZ Points file will include column headers as the first line of the CSV file. The Z coordinate column can be left out of the DAT or CSV file in the **XYZ Options** page in the **Export Options**. Specify the *Scaling source* in the Scaling page of the **Export Options** dialog to export the coordinates in page or map units.

XYZ Export Options Dialog

See XYZ Points File Export Options Dialog

See Export Options - Scaling Page

XYZ Export Automation Options

See XYZ Points File Export Automation Options

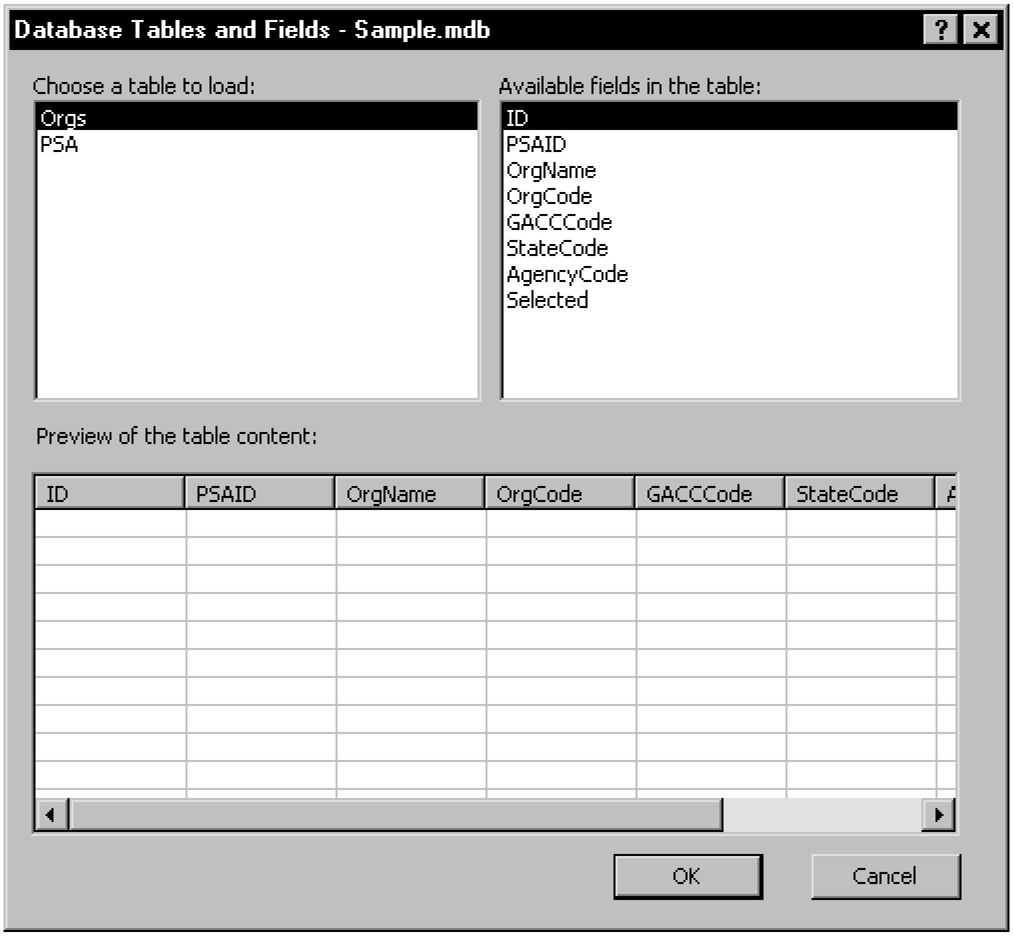
Import Options

Microsoft Access .MDB and .ACCDB Import Options Dialog

Microsoft Access .MDB is a binary database file format used by pre-2007 versions of Microsoft Access. The .ACCDB format is used in Access 2007 and 2010. **Grapher** can import data from tables and queries in both Access .MDB and .ACCDB formats.

Database Tables and Fields Dialog

In the worksheet, select **File | Import** to load a .MDB or .ACCDB file. The **Database Tables and Fields** dialog allows you to choose what table or query to load and preview the data that will be imported.



*Specify .MBD or .ACCDB import options in the **Database Tables and Fields** dialog.*

Choose a Table to Load

If the .MDB or .ACCDB file contains multiple tables and queries, you can select which table or query to load in the *Choose Table To Load* list.

Available Fields in the Table

The *Available fields in the table* displays all of the available fields in the table.

Preview of the Table Content

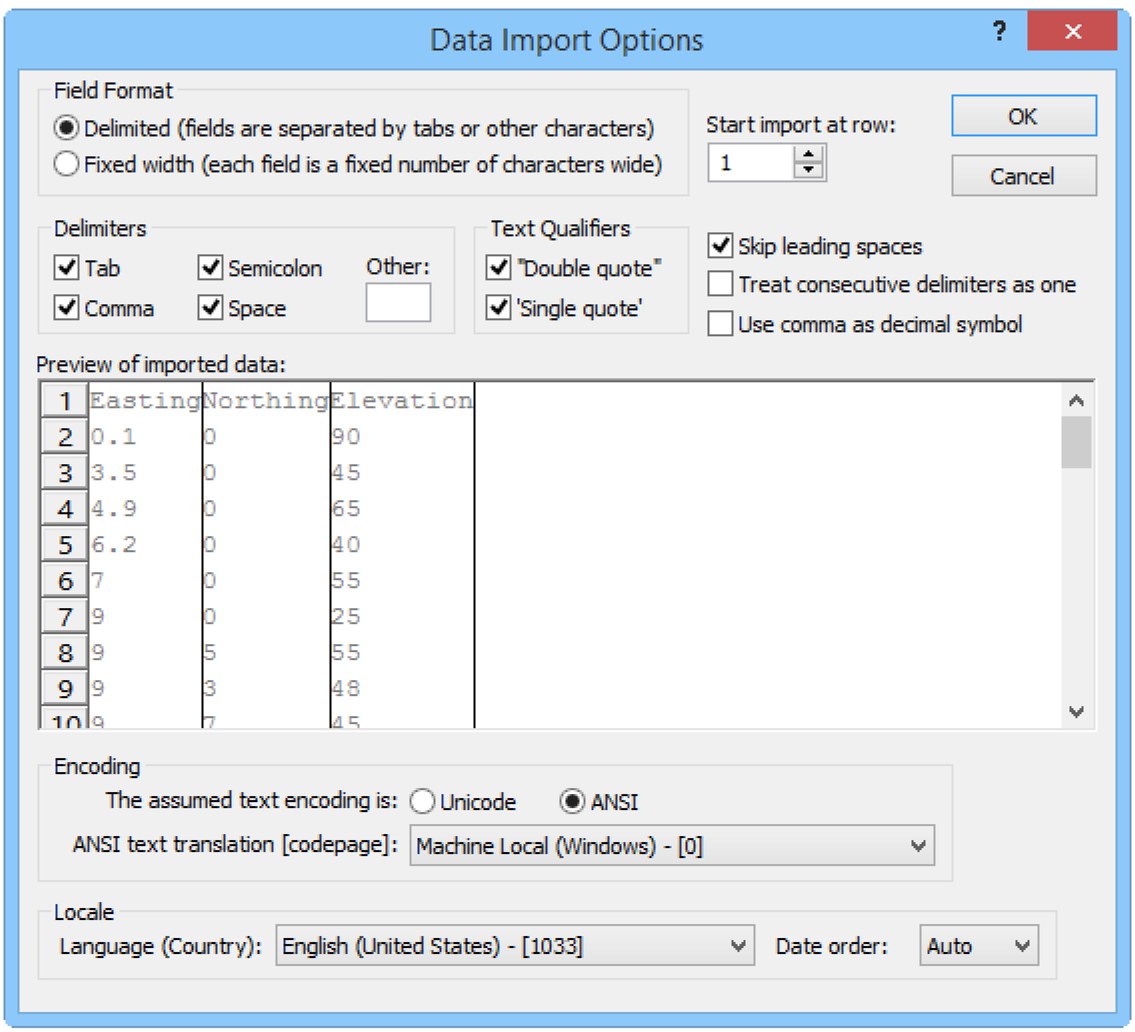
A preview of the selected table content is shown in the *Preview of the table content* section.

Data Import Options

If a file is in an ASCII text format with an unrecognized file extension, the **Data Import Options** dialog appears when opening the file. Choose the *Delimiters* used in the file (*Tab*, *Comma*, *Semicolon*, *Space*, or *Other*), and the *Text Qualifiers* used in the file (*Double Quote* or *Single Quote*).

Data Import Options Dialog

The **Data Import Options** dialog may appear when importing tabular data from delimited text files (i.e. .DAT, .CSV, .TXT). These file formats are assumed to have one record per line in which each record contains a fixed number of numeric data fields.



*The **Data Import Options** dialog allows you to specify import options.*

Field Format

Specify the format of the input fields in the *Field Format* group. The options are *Delimited*or*Fixed Width*.

Delimited

Choose *Delimited (fields are separated by tabs or other characters)* if the imported data uses delimiters (tab, semicolon, comma, space, other) to separate data fields. The *Delimiters* group is used to specify how the fields are separated if *Delimited (fields are separated by tabs or other characters)* is the selected *Field Format*.

Fixed Width

Choose *Fixed Width (each field is a fixed number of characters wide)* if the imported data uses a fixed width to separate data fields.

Start Import at Row

Specify the row number at which to start the data import in the *Start import at row* box. To change the first row to import, highlight the existing value and type a new value or click the  buttons to increase or decrease the value. For example, a value of one will start the data import at row one. A value of five will start the data import at row five and ignore the data in rows one through four.

Delimiters

Choose the desired delimiters to be used during the import process by checking the box next to *Tab*, *Comma*, *Semicolon*, or *Space*. You may also enter a custom delimiter in the *Other* box. More than one delimiter may be checked.

Text Qualifiers

Check the box next to *Double Quote* or *Single Quote* in the *Text Qualifiers* group to indicate the correct qualifier to identify text values in the data file. Everything between the selected characters will be interpreted as a single value, and any delimiter characters between text qualifiers are ignored and treated as part of the text.

Double Quote

Check the box next to *"Double Quote"* to specify that everything between those marks should be interpreted as a single value, and any delimiter characters between any two quote characters are not treated as a delimiter.

For example, if *Space* is chosen as the delimiter and *Double Quote* is chosen as the text qualifier, the string "Aspen Park" is treated as a single data value due to the double quotes surrounding it, and the space delimiter between the words is treated as part of the value.

Single Quote
Check the box next to *'Single Quote'* to specify that everything between those marks should be interpreted as a single value, and any delimiter characters between any two quote characters are not treated as a delimiter.

For example, if *Space* is chosen as the delimiter and *Single Quote* is chosen as the text qualifier, the string 'Aspen Park' is treated as a single data value due to the single quotes surrounding it, and the space delimiter between the words is treated as part of the value.

Skip Leading Spaces

Check the box next to *Skip leading spaces* to tell the software to ignore spaces that appear before initial text.

Treat Consecutive Delimiters as One

Check the box next to *Treat consecutive delimiters as one* to instruct the software to interpret any consecutive delimiters into a single delimiter rather than breaking to a new column for each consecutive delimiter.

Use Comma as Decimal Symbol

Check the box next to *Use comma as decimal symbol* to interpret every comma as the decimal symbol. The number 123,45 in the file would be displayed as 123.45 in the program worksheet with this option checked.

Preview

The parsed data are shown in the *Preview* section.

Encoding

The *Encoding* section allows the choice of *Unicode* data or *ANSI* data when importing or opening an ASCII data file. Unicode data is often referred to as international data. It would include character sets from Russia, Israel, China, Greece, Hungary, among others. After selecting *Unicode*, select the *ANSI text translation [codepage]* option that will read the data correctly. If the data does not appear correctly in the *Preview* window, the *Encoding* may be specified incorrectly.

ANSI encoding contains characters within the first 256 characters of a font. These are normally in English.

Locale

The locale section of the dialog contains options for determining date/-time values. The *Language (Country)* setting determines which month names are interpreted as part of a date. For example, if *German* (*Germany)* is selected, "Oktober" will be recognized as a valid month name. English month names are always recognized as valid month names. The default *Language (Country)* is determined by the user locale set in the Windows Control Panel. To change the *Language (Country)*, click the current option and select a language from the list.

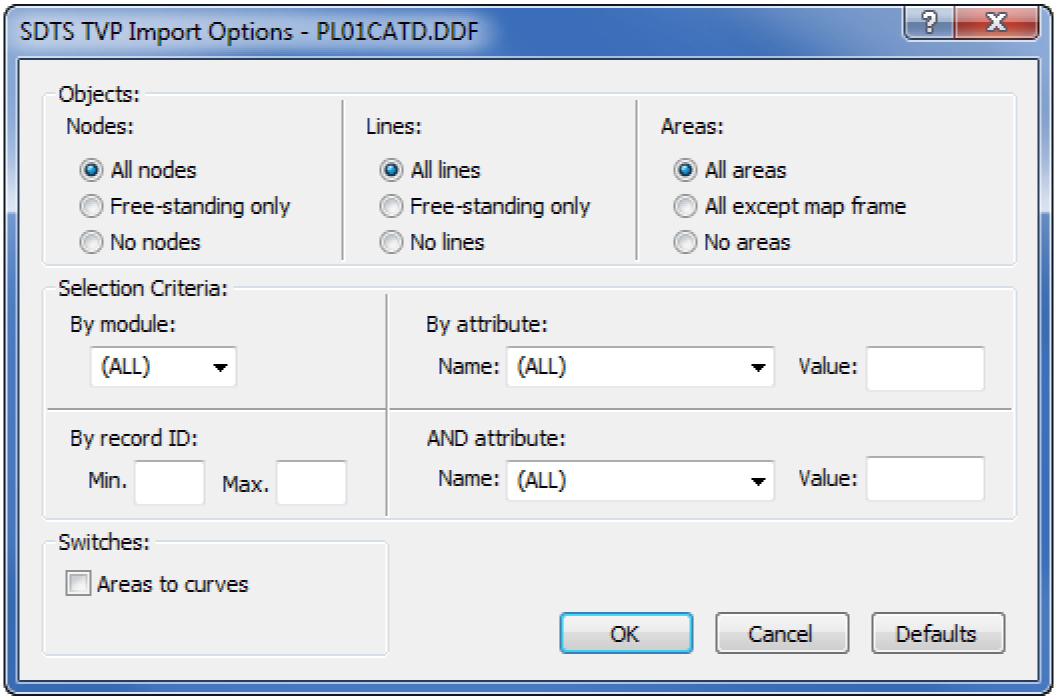
The *Date order* option specifies the order in which dates are written in the data file. The date 02/03/04 is ambiguous and could be Month-Day-Year, Day-Month-Year, Year-Month-Day, etc. The *Date order* option ensures dates in the data file are imported correctly into **Grapher**. The default *Date order* is *Auto*. The standard date order for the *Language (Country)* setting is used when *Date order* is set to *Auto*. Specify the *Date order* for the data file import by clicking the current *Date order* selection and then selecting the desired *Date order* from the list. All six combinations of Day (*D*), Month (*M*), and Year (*Y*) are included in the *Date order* list.

OK or Cancel

Click *OK* to proceed with the import process. Click *Cancel* to close the dialog without importing the data set.

SDTS Topological Vector Profile .TVP Import Options Dialog

Select any .DDF file to open the **Import Options** dialog.



Customize the import options in the ***SDTS TVP Import Options*** *dialog.*

Nodes Options

These options determine which Node items are imported. If *All nodes* is selected, all nodes in the SDTS data set are imported. If *Free-standing only* is selected, only those nodes that are not associated with an area or line are imported. If *No nodes* is selected, none of the nodes are imported.

Lines Options

These options determine which Line items are imported. If *All lines* is selected, all lines in the SDTS data set are imported. If *Free-standing only* is selected, only those lines that are not associated with an area are imported. If *No lines* is selected, none of the lines are imported.

Areas Options

These options determine which Area items are imported. If *All areas* is selected, all areas in the SDTS data set are imported. If *All except map frame* is selected, the areas that make up the outline of the map will not be imported. If *No areas* is selected, none of the areas are imported.

Some SDTS data sets supplied by USGS contain a map frame that is expressed in the data set as a normal polygon instead of an "invisible" polygon (i.e. a "PC" entity instead of a "PW" or "PX" entity in SDTS terminology). In such cases, the All Except Map Frame control will have no effect.

By Module List Box

If the name of a specific module is selected, imported items will be limited to those that reside in the specified module. If *(ALL)* is selected, items will be imported from all modules in the SDTS data set.

By Record ID Edit Boxes

Each item in the SDTS dataset has a unique record ID number. To import only those items within a specific range of record IDs, enter the lowest desired record ID number in the *Min* edit box, and the highest desired record ID number in the *Max* edit box.

By Attribute, AND Attribute Controls

Application-specific attributes are associated with some items in an SDTS data set. To import only those items that have a specific attribute, select the name of the desired attribute in the *Name* list box and enter the value of the desired attribute in the *Value* edit box. If *(ALL)* is selected in the list box, items will be imported without regard to attributes. If both *By Attribute* and *AND Attribute* are specified, only those items that have both of the specified attributes will be imported.

Areas To Curves Check Box

If this is checked, any areas in the data set will instead be imported as lines (curves) instead of polygonal areas.

Defaults Button

The *Defaults* button resets the Import Options to default values. The default options direct the Import Filter as follows: Import free-standing nodes, import free-standing lines, import all areas, don't limit by module, record ID, or attribute, don't import areas as curves, and don't synthesize Ids.

SDTS Topological Vector Profile Import Filter Messages

The following messages may appear while importing SDTS Topological Vector Profile files.

Expected SDTS TVP data. Found SDTS DEM or raster

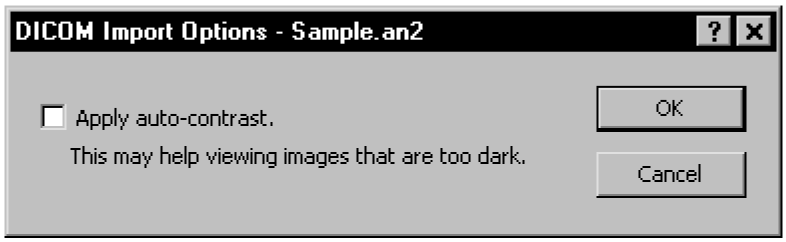
This error message:

> The import file appears to be in an unrecognized format. Make sure the file is a properly formatted SDTS Topological Vector Profile file.

may appear if the selected .DDF file is in the incorrect format. If you receive this message after choosing **File | Import**, you likely have a SDTS DEM file. Try using the **Home | New Graph | Contour Surface | Contour Grid Map** command instead.

DICOM Import Options Dialog

Import a DICOM .AN?, .DCM, file into **Grapher** and the **DICOM Import Options** dialog opens.



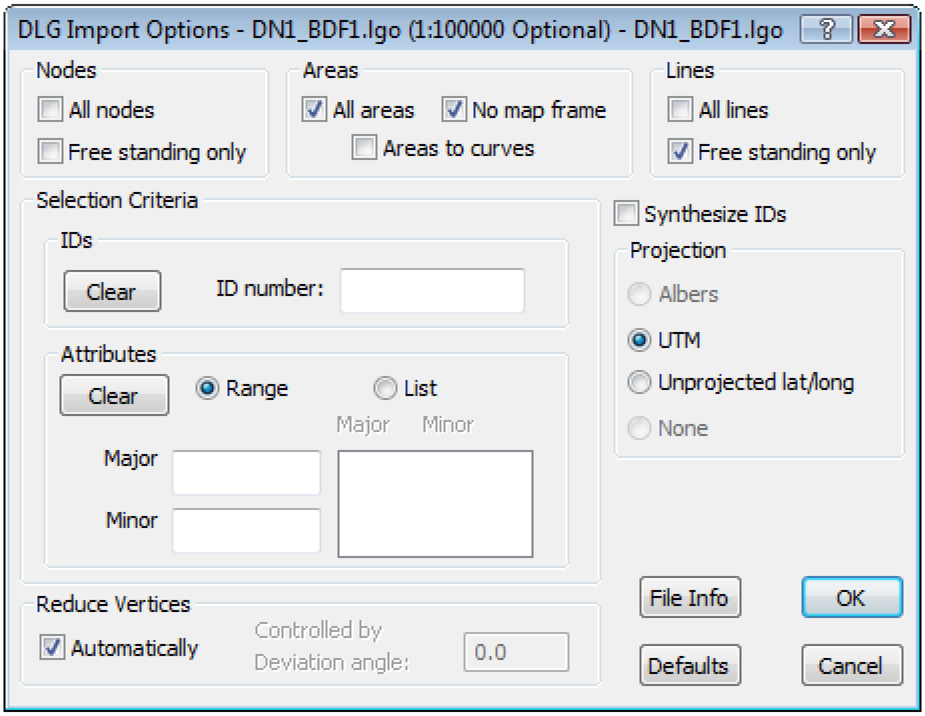
*Customize import options in the **DICOM Import Options** dialog.*

Apply Auto-Contrast

Check the *Apply auto-contrast* box to expand the dynamic range of the import data to fit the maximum extents of the import data type. This can improve visibility (contrast) on images recorded with low dynamic range.

USGS Digital Line Graph .DLG Import Options Dialog

The **DLG Import Options** dialog is displayed when importing a USGS DLG file.



*The **Import Options** dialog controls what is imported from the USGS DLG files.*

Nodes, Areas, Lines

The *Nodes* , *Areas*, and *Lines* groups of check boxes control how the import filter handles the *Node*, *Area* and *Line* entries in the DLG (Digital Line Graph) file.

Nodes

All nodes - If checked, consider all nodes. If they meet the selection criteria, they will be passed to the application as points.

Free standing only - If checked, consider only free-standing nodes. If they meet the selection criteria, they will be passed to the application as points. The only free-standing nodes are the map reference points.

Areas

All areas - If checked, consider all area items. If they meet the selection criteria, they will be passed to the application.

No map frame - If checked, the area that makes up the map frame won't be imported.

Areas to curves - If checked, any selected areas passed to the application will be passed as a series of "curve" objects (lines), as opposed to the usual "area" objects (polygons).

Lines

All lines - If checked, consider all line items. If they meet the selection criteria, they will be passed to the application as "curve" objects.

Free standing only - If checked, consider only free-standing line segments. This is the normal case, since one usually wants line segments that are area boundaries to be passed to the application as part of one or more "area" objects.

Selection Criteria

The *Selection Criteria* section allow you to specify a value (like 140) or range of values (like 6001-6009 inclusive) which limit the items imported. Leave an edit box empty to place no limit and import all available options.

ID Number

Only items with the specified ID or *IDs* within the specified range will be passed back to the application. This is useful for importing a single item (or group of items) of one type.

For example, to import just Area 100, make sure no boxes in the *Nodes* or *Lines* sections are checked. Check the *All areas* box. Set the *ID number* to 100. The import filter considers no nodes or lines and, within areas, only those with ID 100, and passes back one area, Area 100.

To remove the specific *ID number*, click the *Clear* button.

Attributes

The *Attributes* section controls the which objects are imported based on attribute information.

Import by Attribute Range

Select the *Range* option in the *Attributes* section to enable the *Major* and *Minor* attribute options. Only items that have at least one attribute code whose *Major* attribute is within the specified range and whose corresponding *Minor* attribute is within its specified range will be imported into the program.

For example, to import reservoirs only, select the appropriate water bodies file (S??_WB.LGO). Make sure no boxes in the *Nodes* or *Lines* sections are checked. Check the *All areas* box. Enter nothing in the *ID number* box (so all IDs are imported). Select *Range* and enter 40 in the *Major* box (to indicate Water Bodies) and 106 in the *Minor* box (to indicate Reservoirs).

Import by Attribute List

Select the If the *List* radio button in the *Attributes* group is turned on, the list box is enabled. Only items that have at least one attribute code whose *Major* and *Minor* attributes match one of the attribute pairs in the list box will be passed to the application. To add attribute pairs into the list box, click *FileInfo* button to bring up the **File Info** dialog, and double-click the attribute pairs in the Attributes group in the **File Info** dialog. To remove an item from the list box select that item and then click the *Clear* button. You may remove multiple items at one time by selecting multiple items in the list box.

Projections

The Projection radio buttons control how coordinates are returned to the application. DLG files have coordinates calculated using a Universal Transverse Mercator (UTM) or Albers Equal Area Ellipsoid projection. UTM is used in 1:24,000-scale maps and 1:100,000-scale maps, while Albers is used in 1:2,000.000-scale maps.

UTM

The native file coordinates of 1:24,000-scale maps or 1:100,000-scale maps are returned to the application, but the application is also given the parameters used in the UTM projection. Use of this option makes sense only if the application understands how to handle a UTM projection.

Albers

The native file coordinates of 1:2,000,000-scale maps are returned to the application, but the application is also given the parameters used in the Albers projection. Use of this option makes sense only if the application understands how to handle an Albers projection.

Unprojected Lat/Long

The file coordinates are converted from their native form to Lat/Long and the application is informed that it is receiving Lat/Long coordinates. This can lengthen the import time considerably, since substantial computation is involved.

None

The native file coordinates are returned to the application, but the application is told that the projection is unknown.

Reduce Vertices

DLG files typically have many vertices in each line segment, often more than are needed for many tasks. The DLG Import Filter provides two methods for reducing the number of vertices.

Automatically

When you check *Automatically*, the import filter applies an algorithm which requires no further input. This algorithm reduces the number of vertices on most DLG line segments by about 50-80%.

Use Deviation Angle

Achieve finer control over vertex reduction by unchecking the *Automatically* box and entering a *Deviation Angle* (in degrees). Use small angles (5-10 degrees) to eliminate a few points, somewhat larger angles (15-25 degrees) to eliminate more points and use larger angles (30-60 degrees) to eliminate the greatest possible number of points.

USGS DLG files have no text ID items associated with Nodes, Areas or Lines. The line segments that make up the Pecos River, for example, are stored as free-standing line segments with river attribute codes, but there is no way to distinguish those line segments from any other line segments with river attributes. Sometimes, it is useful for investigation purposes to know the numeric ID of imported items. When the Synthesize IDs box is checked, the Import Filter synthesizes a Primary ID for each item using the item's type and numeric ID value. (Examples are "N14" for Node 14, "A237" for Area 237 and "L1067" for Line 1067.)

Defaults

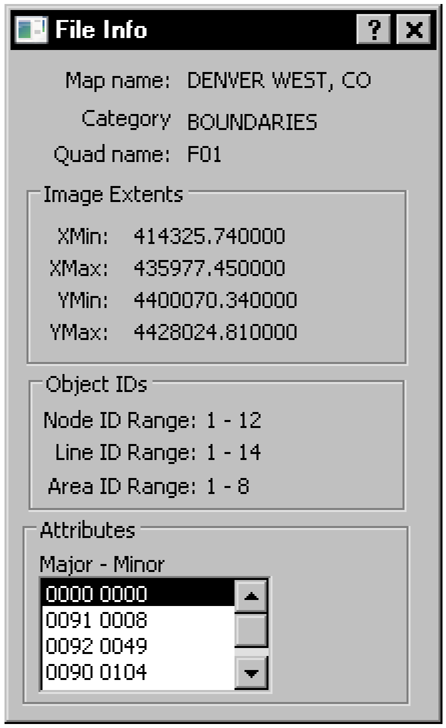
The *Defaults* button resets the Import Options to default values. The default options direct the DLG Import Filter as follows: ignore all Nodes, consider all Areas (selected areas are returned as polygons), consider free-standing lines, place no limiting selection criteria, use UTM or Albers projection and do not synthesize text IDs.

File Info

When the *File Info* is clicked, the File Info dialog appears. The base file information is displayed, such as *Image Extents*, *Object IDs*, and *Major/Minor Attributes*.

USGS Digital Line Graph .DLG File Info Dialog

When the *File Info* button is clicked in the DLG Import Options dialog, the File Info dialog opens. The base file information is displayed, such as *Image Extents*, *Object IDs*, and *Major/Minor Attributes*.

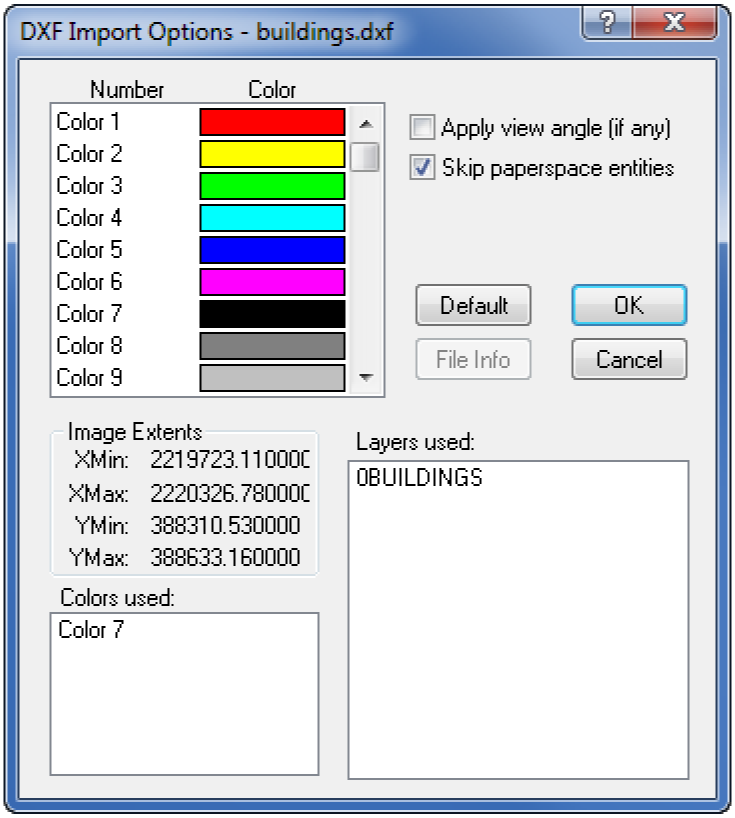


*The **File Info** box displays additional information about the DLG file.*

AutoCAD DXF Import Options Dialog

The **Import Options** dialog allows you to specify options which determine how information in the file is imported.

AutoCAD-compatible Drawing Exchange Format .DXF files contain information describing graphical objects, such as areas, curves, points and text. The DXF Import Filter reads DXF files and structures the information in a form usable by the application.



Customize import options in the ***DXF Import Options*** *dialog.*

Color Number

DXF files contain no direct color information, but use color numbers (1-255) instead. There is an adhoc standard association of colors with the first 7 color numbers: Red, Yellow, Green, Cyan, Blue, Magenta and Black. By double-clicking on items in the COLOR list box, you can change the color associated with a specific color number.

Default

Pressing the *Default* button will assign a default set of colors to each color number.

Apply View Angle

If any viewing angles have been applied in AutoCAD, check *Apply view angle* to preserve these settings. The unrotated coordinates will not be preserved if this box is checked.

Skip Paperspace Entities

To import only graphical entities from AutoCAD's 'modelspace' and skip importing entities from 'paperspace', check the *Skip paperspace entities* option. If this option is not selected, entities from both 'paperspace' and 'modelspace' are imported. This option is checked by default.

File Info

Click the *File Info* button to display the file information concerning the image extents, color numbers used and layers used in the .DXF file. The dialog extends to show this information, as shown above.

Colors Used

Selecting a color number displayed in the *Colors used* list box automatically selects that color number in the *Color* list box.

Layers Used

Double-clicking on a layer displayed in the *Layers used* list box displays the Layer Name dialog, showing the graphical entities present in the layer and a check box showing whether the layer is marked frozen (invisible) or not.

AutoCAD Entities

The point, line, and polygon AutoCAD entities are currently supported.

Point

Created with the AutoCAD POINT command. The current point attributes are used; only the position is extracted from the DXF file.

Line

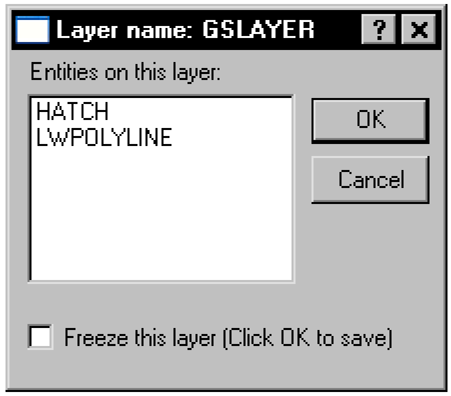
Created with the AutoCAD LINE command. If subsequent LINEs are connected, they are concatenated into a single curve. If the first point equals the last, an area is created instead.

Polygon

Created with the AutoCAD PLINE command. The flag field is read to determine if the polyline is closed or not. If the first and last points are equal, an area is created; otherwise a curve is created. In general, the PLINE command is the most efficient

AutoCAD DXF Import Options - Layer Name Dialog

Double-clicking on a layer displayed in the *Layers Used* list box of the DXF Import Options dialog displays the **Layer Name** dialog, showing the graphical entities present in the layer and a check box showing whether the layer is marked frozen (invisible) or not.



*Specify the layer name for the DXF import in the **Layer Name** dialog.*

Entities on this Layer

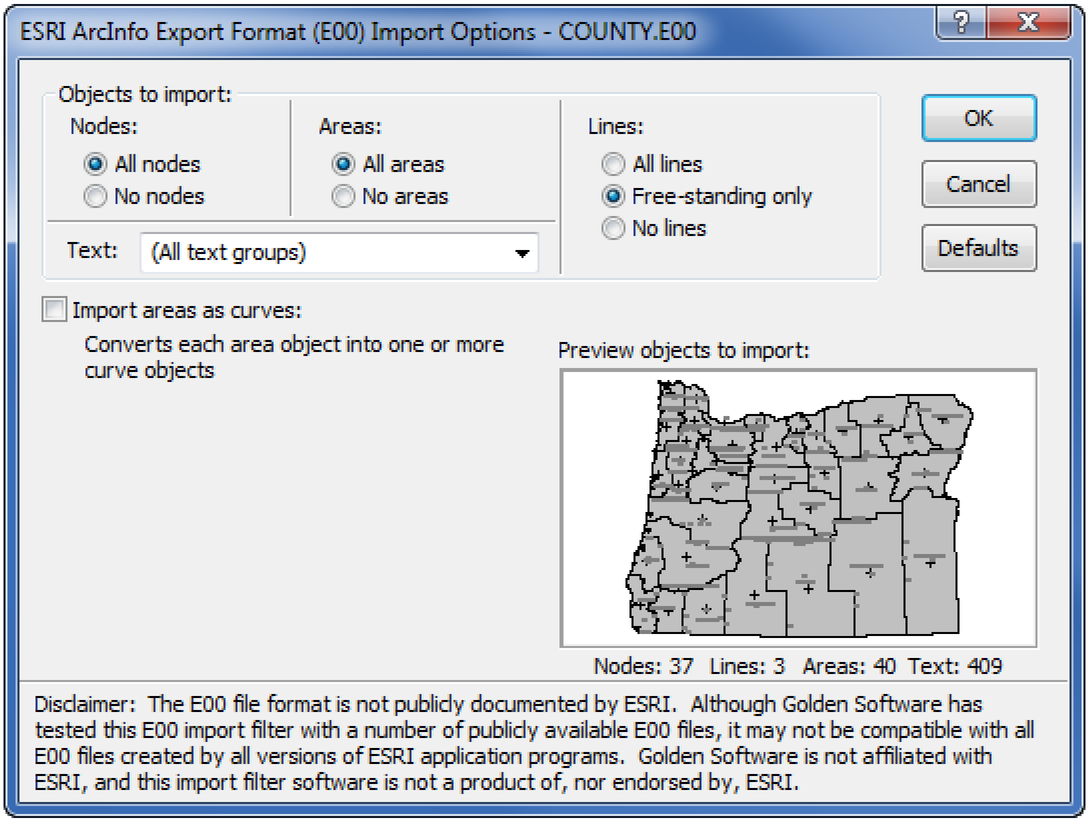
Select a option from the *Entities on this layer* box. Left-click to select an option. The selected option will be highlighted. Only one entity can be selected at once.

Freeze this Layer

Check the *Freeze this layer (Click OK to save)* option to freeze/unfreeze layers prior to importing. Objects in layers that are marked frozen will not be imported into the application.

Esri ArcInfo Export Format .E00 Import Options Dialog

The **Import Options** dialog allows you to specify how information in the file is imported. Each of the controls in this dialog is described below.



Select the E00 import options in the ***Import Options*** *dialog.*

Nodes

These options determine which *Node* items are imported.

- If *All nodes* is selected, all nodes in the drawing are imported.
- If *No nodes* is selected, none of the nodes are imported.

Areas

These options determine which *Area* items are imported.

- If *All areas* is selected, all areas in the file are imported.
- If *No areas* is selected, none of the areas are imported.

Lines

These options determine which *Line* items are imported.

- If *All lines* is selected, all lines in the file are imported.
- If *Free-standing only* is selected, only those lines that are not asso-

ciated with an area are imported.

- If *No lines* is selected, none of the lines are imported.

Text

The selection in this list determines which groups of text items are imported.

- If *All text groups* is selected, all text items from the import file are imported.
- If *No text* is selected, no text items from the import file are imported.
- If the name of a specific group is selected in the list, only the text items from that group are imported. Some import files don't contain any named groups of text items, in which case the only selections possible will be *All text groups* or *No text*.

Import Areas as Curves

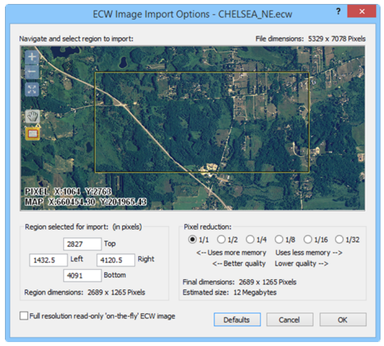
Check the *Import areas as curves* box to convert each area object into one or more curve (line) objects.

Preview Objects To Import Display

This area of the dialog displays a rough preview of the items that are selected for import from the import file. Any lines selected for import are displayed in black. Any areas selected for import are displayed in light gray with a black border. Any nodes selected for import are displayed as black crosses. Any text items selected for import are displayed as dark gray rectangles. Any changes to the dialog controls that effect which objects are selected for import will be reflected in the preview display.

ER Mapper .ECW Import Options Dialog

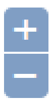
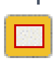
The **ECW Image Import Options** dialog is displayed when an ECW ER Mapper Image file is selected in the Import dialog.



*Customize the ECW pixel reduction, import region, or read-only import in the **ECW Image ImportOptions** dialog.*

Image Preview

The preview section displays a picture of the area to be imported. The preview section contains a low resolution preview of the area.

- Click the  buttons on the left side of the image preview to zoom in or out on the area. Changing the zoom level does not affect the area to import. The area to import is indicated in the preview section by a yellow outline.
- Click the button to fit the entire image in the preview window.
- Click the  button on the left side of the image preview to quickly move the image in the preview section. Click and hold the left mouse button down and drag the image to change the view. Changing the view does not affect the area to import. The area to import is indicated in the preview section by a yellow outline.
- Click the  button on the left side of the image preview to change the extents of the image that is imported. The initial region includes the entire image extents. Click and hold the left mouse button down and drag the mouse over the area to import. The zoom extents update and the yellow box coincides with the area drawn. The *Region selected for import* section also updates. Only the portion of the image highlighted by the yellow box will be imported.

Import Region

The region for import can be selected in the image preview or in the *Region selected for import* section. The initial region includes the entire image extents. Type a value in pixels into the *Top*, *Left*, *Right*, and *Bottom* fields to specify the imported region. The yellow outline in the image preview is updated as the values are changed.

Pixel Reduction

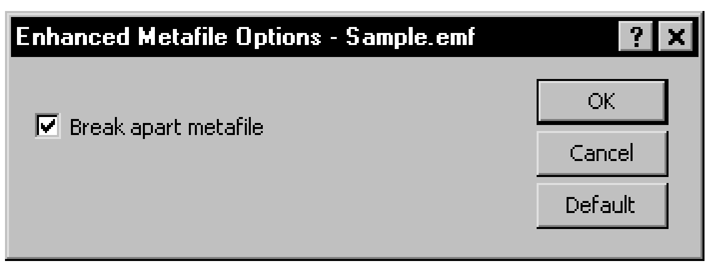
Since some ECW images can be extremely large once expanded into memory, the import filter allows the image to be reduced in dimensions by 1/2 to 1/32 of the original size via the options in the **ECW Image Import Options** dialog. Choose from *1/1* (Uses the most memory, best quality), *1/2, 1/4, 1/8, 1/16,* to *1/32* (Uses the least memory, lowest quality). The *Final dimensions* field displays the final dimensions of the imported region. The *Estimated size* field displays the estimated image size in Megabytes (MB).

Read-only Import

The *Full resolution read-only 'on-the-fly' ECW image* option imports the full ECW file in its native form as a highly-compressed, read-only image. If a portion of the image is needed for display or output, the necessary portion is extracted and decompressed "on the fly." This option provides quick import and interactive panning and zooming without using large amounts of RAM or disk space. However once an image is imported with *Full resolution read-only 'on-the-fly' ECW image* checked, the image cannot be modified.

Windows Enhanced Metafile .EMF Import Options Dialog

The **Enhanced Metafile Options** dialog allows you to specify options which determine how information in the file is imported. A Windows Enhanced Metafile .EMF is a collection of objects combined together to produce an image.



Specify the EMF import options in the ***Enhanced Metafile Options****dialog.*

Break Apart Metafile

Check the *Break apart metafile* option to break the metafile into its constituent graphical objects during import. Uncheck the option to leave the metafile as a single group object.

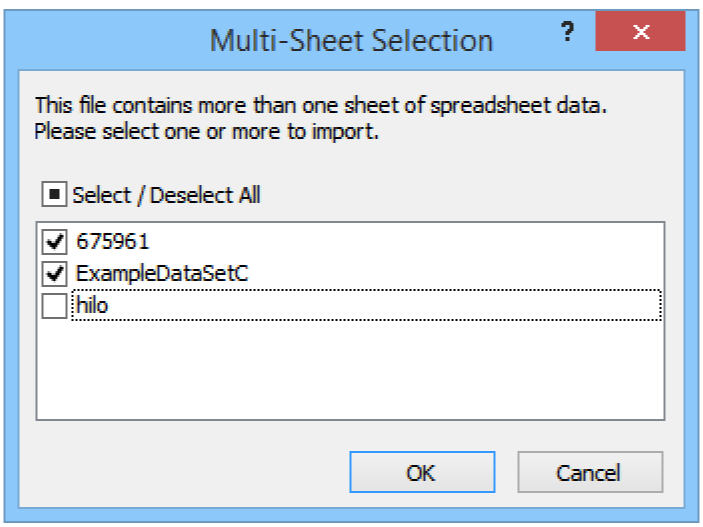
Excel Import Options Dialog

Grapher can import Excel .XLS, .XLSM, and .XLSX file types.

Importing an Excel File with Multiple Sheets

Grapher can import multiple sheets of Excel spreadsheet data at a time. If you are importing an Excel file with multiple sheets, the **Multi-Sheet Selection** dialog will appear. Select one or more sheets to import and click the *OK* button. A check mark indicates the sheet is selected for import. No check mark indicates the sheet will not be imported.

- Select or deselect sheets by clicking the check box or sheet name.
- Select or deselect multiple contiguous sheets by clicking the first desired sheet. Next hold SHIFT and click the last desired sheet. The boxes are either all checked or all unchecked between the clicked sheets.
- Select all of the sheets or none of the sheets by clicking the *Select / Deselect All* check box. The *Select / Deselect All* check box displays a check mark when all sheets are selected. The *Select / Deselect All* check box is empty when no sheets are selected and displays a black square when some sheets are selected.



*Select the sheet or sheets to import in the**Multi-Sheet Selection**dialog.*

Image (Bitmap) Import Options Dialog

The **Import Options** dialog allows you to specify options which determine how information in the file is imported. The **Import Options**dialog does not appear by default. If the file you have selected contains more than one image in bitmap form, then indicate which image (1,2,3,...) you want imported.

Spatial Reference Information

Some applications associate spatial reference information (such as projection, datum, and georeference parameters) with images representing a region of the Earth’s surface. Most image file storage formats don’t have a way to store the spatial reference information in the same file as the image. For these formats, the only way the spatial reference information can be stored is in a separate file. One image storage format, GeoTIFF (Geographic Tagged Image File Format), allows the spatial reference information to be stored in one file, along with the image.

Some (but not all) Golden Software applications can utilize the additional spatial reference information associated with an image file. If the program you’re running is one that can, and one or more sources of spatial reference information are available for the image file you are importing, a Spatial Reference Source list box will be displayed, allowing you to chose the source to use. Recognized sources of spatial information include:

(None)

Choose this option if you don’t want any spatial reference information to be passed to the program, even if it’s available.

Embedded GeoTIFF Parameters

This option is only available if you have chosen an image file that is in TIFF (Tagged Image File Format). If you have and this option is chosen, the spatial reference information will be extracted from GeoTIFF tags embedded within the file. GeoTIFF is a vendor-independent format that can be generated by a variety of geographic software packages.

Golden Software Reference File

Golden Software supports a text-based format for storing spatial reference information in a separate file.

Blue Marble .RSF File

Blue Marble Geographics supports a text-based format for storing georeference information only in a separate file.

Esri World File

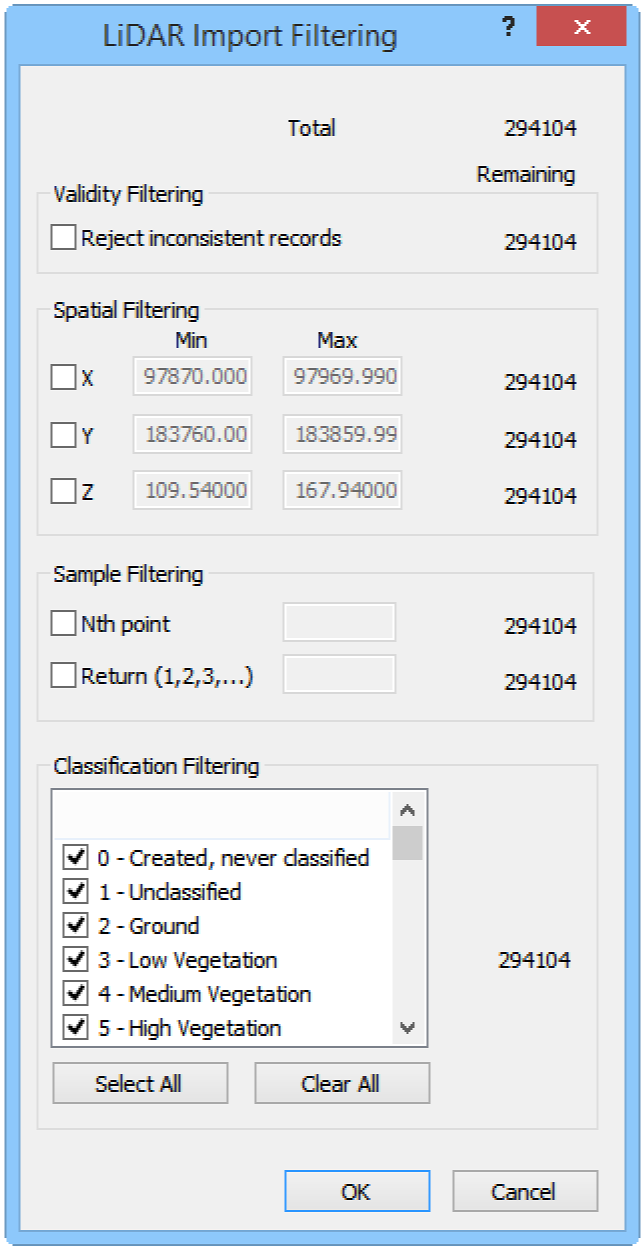
Environmental Sciences Research Institute (Esri) supports a text-based format for storing georeference information only in a separate file.

Golden Software Boundary .GSB Import Options Dialog

The **Import Options** dialog does not display when importing a .GSB file into **Grapher**.

LiDAR Import Filtering Dialog

Click the File | Import command in a worksheet or the File | Open command to load a .LAS or .LAZ file. The **LiDAR Import Filtering** dialog allows you to specify options which determine how information in the file is imported.



*Customize import options in the **LiDAR Import Filtering** dialog.*

Total Points

The total number of points in the data file are listed at the top right of the dialog. As LiDAR data is typically extremely large, it is recommended that either *Spatial Filtering* or *Sample Filtering* be applied to the data.

Validity Filtering

Check the box next to the *Reject inconsistent records* option to remove all invalid or inconsistent data from import. When this box is unchecked, all data are passed to the import filter when importing a .LAS file.

Spatial Filtering

Check the boxes next to *X, Y,* or *Z* to filter the data based on the X, Y, or Z data limits. This is useful for selecting only a portion of the data based on geographic extents. After checking the box, highlight the value next to *X, Y,* or *Z* in either the *Min* or *Max* column. Type a new value. The number of points in the *Remaining* column will update to show how many points will exist in the data table after the filtering has been done on the data.

Sample Filtering

Check the box next to *Nth point* or *Return* to filter the data further. The *Nth point* returns every nth point, as set by the value *N*. If you want every other point, type 2 in the box next to *Nth point*. If you want every third point, type 3 in the box.

The *Return* values filter the data based on the laser return. Type the value of the laser return in the box next to *Return*. Multiple returns can be used to filter the data by typing a comma separated list of *Return* values. The return is the filter applied directly to the LAS data detecting waveform peaks. The timing of the peaks is given in the LAS file as a distinct *Return*. Most LiDAR systems designed for topographic mapping are optimized to record 3 return pulses. First returns can be used to create digital surface models that include features above the ground surface, such as buildings, bridges, and tree canopy. Intermediate returns are helpful in separating vegetation from solid objects among the above ground features. Final returns are normally the first approximation of the bare ground surface. If you only want the data from the ground surface, you might type in 3 for the *Return* value.

Classification Filtering

To import only data with a certain classification, check the box next to the classification type. For instance, if you only want to import data that is classified as LiDAR class *2-Ground*, uncheck all other boxes in the *Classification Filtering* section and check the box next to *Ground*.

Select All or Clear All

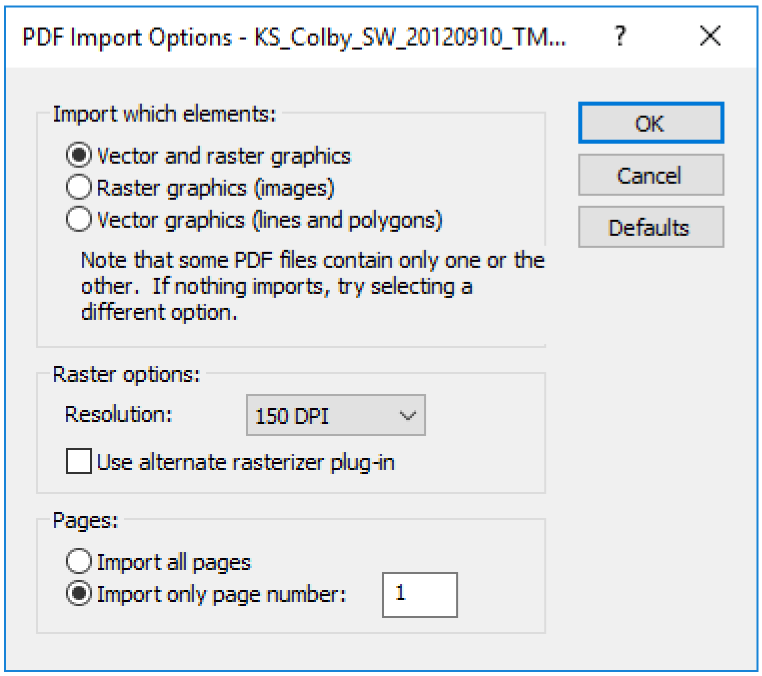
Click the *Select All* button to check all of the classes in the *Classification Filtering* section. Click the *Clear All* button to uncheck all of the classes in the *Classification Filtering* section. After clicking the *Clear All* button, one or more individual classes should be checked. Otherwise, no information will be imported.

OK or Cancel

Click *OK* to close the **LiDAR Import Filtering** dialog and import the .LAS file. Click *Cancel* to close the **LiDAR Import Filtering** dialog and not import the .LAS file.

PDF Import Options Dialog

The **PDF Import Options** dialog is displayed when importing PDF files. Vector graphics from the PDF file are imported as lines and polygons. Raster graphics from the PDF file are imported as images.



*The **Import Options** dialog controls what is imported from the PDF file.*

Import Which Elements

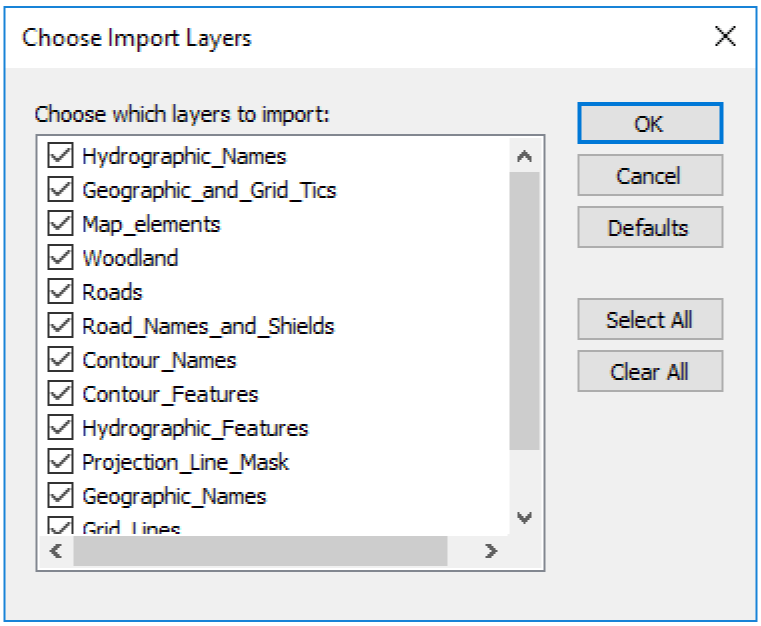
Select which elements you wish to import from the PDF in the *Import which elements* section.

- Select *Vector and raster graphics* to import both vector and raster graphics from the file.
- Select *Raster graphics (images)* to import only images from the file.
- Select *Vector graphics (lines and polygons)* to import only polylines and polygons from the file.

A PDF file may not contain both graphic types. Selecting *Vector graphics (lines and polygons)* when the PDF file contains only raster graphics will result in an empty import. If you are unsure which graphics types are present in the PDf file, select *Vector and raster graphics*.

Choose Vector Layers

A PDF with vector graphics may contain multiple vector graphic layers. The *Choose Vector Layers* option is available when *Vector and raster graphics* or *Vector graphics (lines and polygons)* is selected. Click *Choose Vector Layers* to select which vector layers to import from the PDF in the **Choose Import Layers** dialog.



*The **Choose Import Layers** dialog controls which vector layers imported from the PDF file.*

Layers with a selected check box are imported. Layers with a cleared check box are not imported. Click the check box to select or deselect the layer. Click *Select All* to select all layers. Click *Clear All* to clear all layers. At least one layer must be selected in the **Choose Import Layers** dialog.

Raster Options

The *Raster options* section includes the import options for raster graphics.

Resolution

The *Resolution* option controls the resolution of the imported images. Available options are 50, 75, 100, 125, 150, 200, 250, 300, 600, or *Custom*

DPI. The higher the DPI, the clearer the image is when imported, but the larger the file size. The default is 150 DPI. When *Custom DPI* is selected, type a value into the *Render resolution* box to specify the resolution of the imported image. The *Render resolution Custom DPI* value must be between 50 and 1200.

Alternate Rasterizer

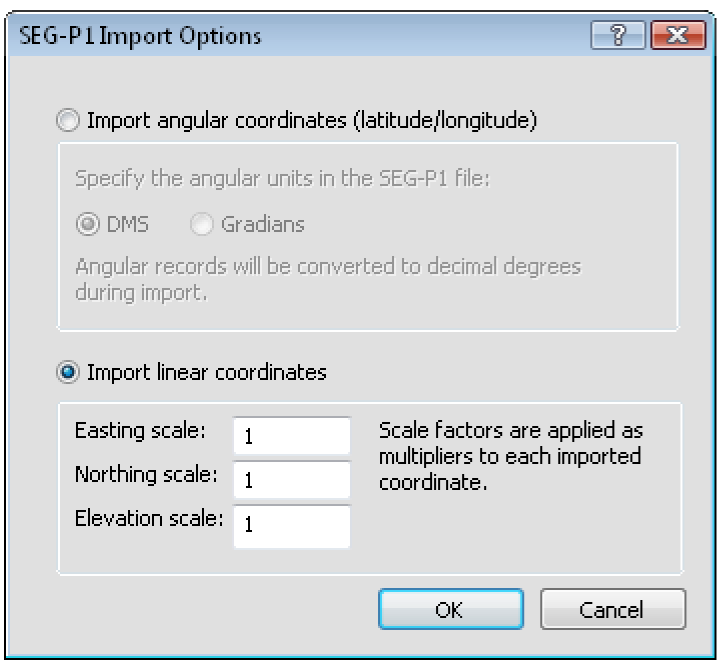
The *Use alternate rasterizer plug-in* option uses a different import filter to read in raster graphics. If the raster graphics appear incorrect after import when the *Use alternate rasterizer plug-in* option is cleared, import the PDF with the *Use alternate rasterizer plug-in* option selected.

Pages

When a PDF contains more than one page, the *Pages* options control which page is imported into the program. *Import all pages* imports each page in the PDF. *Import only page number* imports only the specified page number into the program. To change the page number to import, select the *Import only page number* option and type the page number to import.

SEG P1 Import Options Dialog

The **SEG-P1 Import Options** dialog allows you to specify options which determine how information in the file is imported. A SEG P1 file is a collection of point locations, usually used in geophysical shotpoints.



*Specify the SP1 import options in the **SEG-P1 Import***

***Options**dialog.*

Coordinate Format

Select *Import angular coordinates (latitude/longitude)* if the data in the SP1 or SEG file is in latitude and longitude. Select *Import linear coordinates* if the data in the SP1 or SEG file is in a Cartesian coordinate system or an unknown linear coordinate system. Units can be in degrees, gradians, meters, feet, or any unknown units.

DMS or Gradians

When the *Import angular coordinates (latitude/longitude)* is selected, the *Specify the angular units in the SEG-P1 file* option becomes available. If the file contains degrees, minutes, and seconds, select *DMS*. If the file contains gradians, select *Gradians*.

Scale Factors

When the *Import linear coordinates* is selected, the *Easting scale, Northing scale,* and *Elevation scale* options are available. Highlight the existing value and type the new scale factor value in the box. Scale factors are multiplied by the values in the import file to get appropriate coordinates. This might be necessary if the *Easting* and *Northing* are in one set of units and the *Elevation* is in another set of units.

OK or Cancel

Click *OK* to continue importing the tabular SP1 data into a new table or the vector format SP1 file into a new base map. Click *Cancel* to quit importing the file.

LizardTech MrSID .SID Import Options Dialog

*Customize the SID pixel reduction, import region, or read-only import in the**SID Image Import Options**dialog.*

Image Preview

The preview section displays a picture of the area to be imported. The preview section contains a low resolution preview of the area.

- Click the buttons on the left side of the image preview to zoom in or out on the area. Changing the zoom level does not affect the area to import. The area to import is indicated in the preview section by a yellow outline.
- Click the button to fit the entire image in the preview window.
- Click the button on the left side of the image preview to quickly move the image in the preview section. Click and hold the left mouse button down and drag the image to change the view. Changing the view does not affect the area to import. The area to import is indicated in the preview section by a yellow outline.
- Click the button on the left side of the image preview to change the extents of the image that is imported. The initial region includes the entire image extents. Click and hold the left mouse button down and drag the mouse over the area to import. The zoom extents update and the yellow box coincides with the area drawn. The *Region selected for import* section also updates. Only the portion of the image highlighted by the yellow box will be imported.

Import Region

The region for import can be selected in the image preview or in the *Region selected for import* section. The initial region includes the entire image extents. Type a value in pixels into the *Top*, *Left*, *Right*, and *Bottom* fields to specify the imported region. The yellow outline in the image preview is updated as the values are changed.

Pixel Reduction

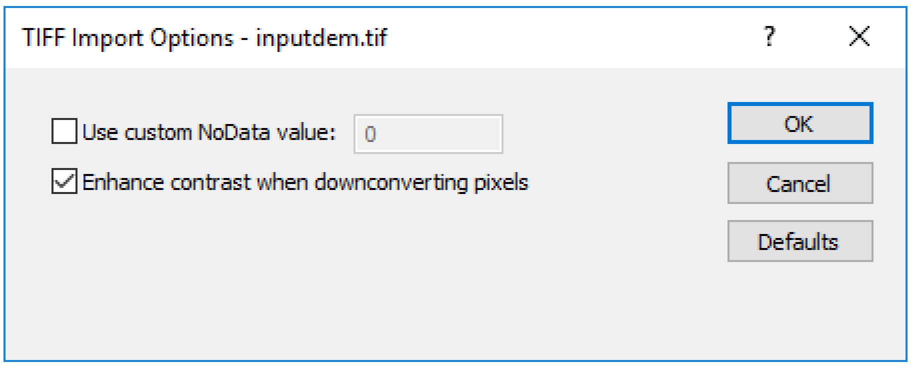
Since some SID images can be extremely large once expanded into memory, the import filter allows the image to be reduced in dimensions by 1/2 to 1/32 of the original size via the options in the **SID Image Import Options** dialog. Choose from *1/1* (Uses the most memory, best quality), *1/2, 1/4, 1/8, 1/16,* to *1/32* (Uses the least memory, lowest quality). The *Final dimensions* field displays the final dimensions of the imported region. The *Estimated size* field displays the estimated image size in Megabytes (MB).

Read-only Import

The *Full resolution read-only 'on-the-fly' MrSID image* option imports the full MrSID file in its native form as a highly-compressed, read-only image. If a portion of the image is needed for display or output, the necessary portion is extracted and decompressed "on the fly." This option provides quick import and interactive panning and zooming without using large amounts of RAM or disk space. However once an image is imported with *Full resolution read-only 'on-the-fly' MrSID image* checked, the image cannot be modified.

TIF Tagged Image Import Options Dialog

Grapher can import TIF image files. TIF file can also be used as grid files. When a TIF file is used as a grid file, the **TIFF Import Options** dialog is displayed.



Set the NoData*value in the**TIFF Import Options**dialog.*

Use Custom NoData Value

Leave the *Use custom NoData value* option cleared to use the NoData value specification in the TIF file. If you wish to specify the NoData value, select the *Use custom NoData value* option, and type the desired NoData value in the field.

Some applications may export a TIF raster without correctly specifying the NoData value in the file header. In these cases **Grapher** will treat all the values in the grid as valid. If your grid-based map looks incorrect, use the Grid Info command and/or the Z value in the status bar cursor coordinates to determine the correct NoData value. The NoData value is likely to be the minimum or maximum which can be determined with **Grid Info**. Hover the cursor over a known NoData (blanked) region and read the value in the cursor coordinates section of the status bar. Next create a new map with the TIF grid file and specify the correct NoData value in the **TIFF Import Options** dialog.

Enhance Contrast when Downconverting Pixels

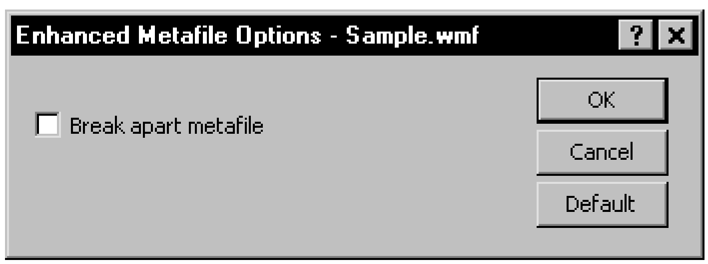
Select the *Enhance contrast when downconverting pixels* option to remap the raster TIFF Z values to a range from 0 to 255 to display the raster data file as a TIFF image. Clear the *Enhance contrast when downconverting pixels* option to import the TIFF Z values without transformation. The *Enhance contrast when downconverting* option should be selected when importing the TIFF as an image and cleared with using the TIFF as a grid file.

Defaults

Click *Defaults* to return the **TIFF Import Options** dialog to the default settings.

Windows Metafile Import Options Dialog

The **Enhanced Metafile Options** dialog allows you to specify options which determine how information in the file is imported. A Windows Metafile .WMF and Enhanced Windows Metafile .EMF are collections of objects combined together to produce an image.



Specify the import options in the ***Enhanced Metafile Options****dialog.*

Break Apart Metafile

Check the *Break apart metafile* option to separate the objects into individual entities. Do not select this option if you want the objects to remain a single collection.

Import-Filter Messages

The following messages may appear while attempting to import .WMF, .EMF or .CLP files.

Clipboard file contains no picture in metafile form!

The clipboard file may contain information in a variety of forms (text, bitmap, metafile). This Graphical Import Filter component can only import pictures stored in Windows metafile format. The clipboard file you selected contains no picture in metafile format. You may still be able to get the information into the Golden Software application by launching the Windows Clipboard Viewer utility (CLIPBRD.EXE), opening the .CLP file, switching back to the Golden Software application and then selecting **Home | Clipboard | Paste | Paste Special**.

No Destination Bitmap for Bit Pattern
Attempt to create a bit pattern on a bitmap while the latter doesn't exist. Make sure the file has been created correctly.

Import Automation Options

Microsoft Access .MDB and .ACCDB Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
“SQLSTR=, Table=table1”
```

Option	Action	Default
SQLSTR	Structured Query Language access string.	No
Table	Name of database table.	No

ASCII .DAT, .TXT Data File Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Delimiter=comma; TextQualifier=singlequote;SkipExtraDelimiters=0"
```

This would set the delimiter character to a comma and the text qualifier character to the single-quote mark (‘).

Option	Action	Default	Description
ColumnBreaks	N,N,N...	no option	*ColumnBreaks* is used when *UsedFixedWidth* is

		string	set to 1. The field separators are a series separated by commas or spaces, for example: 6 12 20 25.
DecimalSymbol	period = use . comma = use ,	period	Sets the decimal symbol to period or comma
Delimiter	tab = tab comma = comma semicolon = semicolon space = space equals = equals other = enter the delimiter character		The *Delimeter* is the character that separates data cell values. You can use more than one delimiter in the string. For example, "Delimiter=comma,%,tab
EatWhiteSpace	0 = Do not skip extra space and tab in the data 1= Skip extra space and tab in the data	0	*EatWhiteSpace* removes extra space and tab characters preceding and following data. A 0 means not to skip the extra space. For example, " 1 2" would leave the column A blank and import data into the columns B and C. A 1 means to skip the extra space. For example, " 1 2" would import data into the columns A and B.
FilterID	String	""	FilterId specifies the file format extension if the extension entered for FileName is unknown. If the command calling the import options string has a *FilterID*property, you do

			not need to use this*FilterID*.
ImportCodePage	String	""	The name of the ANSI code page to use when importing Unicode data
Sheet	String, sheet name		*Sheet* opens the specified sheet in an Excel workbook.
SkipExtraDelimiters	0 = Do not skip extra delimiters in the data 1= Skip extra delimiters in the data	1	*SkipExtraDelimiters* specifies whether multiple delimiters are treated as one delimiter. "SkipExtraDelimiters=0" means "don't skip the extra delimiters" For example, 1,,2,,,3 would import into columns A,C, and F. "SkipExtraDelimiters=1" means "do skip extra delimiters". For example, 1,,2,,,3 would import into columns A, B and C.
SQLSTR	SQL string	No	Structured Query Language access string.
StartRow	N	1	*StartRow* is the row number at which to begin importing.
Table	*table or query name*		*Table* opens the specified sheet in an Excel workbook.
TextQualifier	double-quote = double-quote(") single-quote = single-quote(') none = none other = enter the		The *TextQualifier* specifies the character that surrounds cells containing text. You can use more than one text qualifier in the string. For example, "TextQualifier=doublequote,%

	text qualifier		
UseFixedWidth	0 = No 1 = Yes	0	*UseFixedWidth* uses a fixed width for columns during import.
Locale	String	System Locale	*Locale* is the locale ID in decimal values. The default locale is determined by the locale setting in the Windows Control Panel.
DateOrder	0 = Auto 1 = MDY (Month, Day, Year) 2 = DMY 3 = YMD 4 = MYD 5 = DYM 6 = YDM	0	The *DateOrder* specifies the order in which dates are written in the data file. When *DateOrder* is set to 0, the standard date order from the *Locale* is used.

Remarks

When specifying a delimiter and text-qualifier a semicolon is placed between the option pair, for example:

```
"Delimiter=semicolon,tab,comma ; TextQualifier=singlequote,doublequote"
```

Golden Software Blanking .BLN Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Defaults=1,AreasToCurves=1"
```

This would first set all import options to their default values, then set the *AreasToCurves* option value to one, which would specify that any areas imported be converted to closed curves.

Option	Action	Default
Defaults=1	Set all options to their default values	No
ForgetOptions=1	Don't remember options for later use	No
AreasToCurves=1	Convert area objects to closed curves	No

Atlas Boundary .BNA Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Defaults=1,AreasToCurves=1"
```

This would first set all import options to their default values, then set the *AreasToCurves* option value to one, which would specify that any areas imported be converted to closed curves.

Option	Action	Default
Defaults=1	Set all options to their default values	No
ForgetOptions=1	Don't remember options for later use	No
AreasToCurves=1	Convert area objects to closed curves	No

SDTS Topological Vector Profile [.TVP] Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Defaults=1,AreasToCurves=1"
```

This would first set all import options to their default values, then set the *AreasToCurves* option value to one, which would specify that any areas imported be converted to curves (lines).

Option	Action	Default
AreasToCurves	Convert all polygons to polylines	
WhichLines=0	Import all lines	
WhichLines=1	Import freestanding lines	
WhichLines=2	Import no lines	
WhichNodes=0	Import all nodes	
WhichNodes=1	Import no nodes	
WhichAreas=0	Import all areas	
WhichAreas=1	Import no areas	
WhichText=2	Import all text	
WhichText=1	Import no text	
WhichText=m	Import specific text group as index into m_Reader's list of text groups	

DICOM Medical Image File .DIC, .DCM, AN? Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

"Defaults=1,AutoContrast=1"

This would first set all import options to their default values, then set the AutoContrast option value to one, which would specify that the dynamic range of the imported data will be expanded to improve the contrast of the image.

Option	Action	Default	Description
AutoContrast	0 = No 1 = Yes	0	When set to 0, the data will be imported as-is, without adjustment. When set to 1, the dynamic range of the imported data will be expanded to improve the contrast of the image.

USGS Digital Line Graph Boundary [.DLG] Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. Parameters for the *Attributes* list box, *Range* and *List* radio buttons are not available. If the program is driven from a script, use *MajorSel* and *MinorSel* parameters instead. A typical example would be:

```
"Defaults=1,AreasToCurves=1"
```

This would first set all import options to their default values, then set the *AreasToCurves* option value to one, which would specify that any areas imported be converted to closed curves.

Option	**Action**	**Default**	**Description**
AllNodes	0 = No 1 = Yes	0	Import all nodes (point entities).
FreeNodes	0 = No 1 = Yes	0	Import only free-standing nodes (points that aren't part of another entity).
AllAreas	0 = No 1 = Yes	1	Import all areas (polygons).
NoMapFrame	0 = No 1 = Yes	1	Don't import the entities that make up the map frame.
AreasToCurves	0 = No 1 = Yes	0	Convert areas (polygons) to curves (poly- gons).
AllLines	0 = No 1 = Yes	0	Import all lines.
FreeLines	0 = No 1 = Yes	1	Import only free-standing

			lines (lines that aren't part of another entity).
Synthesize	0 = No 1 = Yes	0	If 1, a unique object ID is synthesized for each object form the object's type, record number, an d name (if applicable).
Projection	0 = Coordinates in the file are projected (UTM or Albers Equal Area projection, depending on the file) 1 = Coordinates in the file are projected, but are to be converted to latitude/longitude during import 2 = Coordinates in the file are unknown or not projected	Varies according to the DLG header information	Specify what type of coordiantes are contained in the import file.
IDSel	M-N		Only consider entities with IDs matching M, or in the range of M-N. For example, "IDSel=1-5".
MajorSel	M-N		Only consider entities whose Major Attribute is M, or in the range of M-N. For example, "MajorSel=1-5".
MinorSel	M-N		Only consider entities whose

			Minor Attribute is M, or in the range of M-N. For example, "MinorSel=1-5".
ThinAuto	0 = No 1 = Yes	1	Automatically thin vertices.
Deviation	N.N	0.0	If ThinAuto (above) is 0, you can manually specify the amount of thinning. The Deviation value in degrees determines how aggressively vertices are thinned during import. For N.N, use small angles (5 to 10 degrees) to eliminate just a few points, larger angles (15 to 25 degrees) to eliminate more points, and even larger angles (30 to 60 degrees) to thin points very aggressively.

AutoCAD DXF Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Defaults=1,Color3=0;0;255"
```

This would first set all import options to their default values, then set the color associated with DXF Color Table entry #3 to Blue. All entities associated with Color Table entry #3 will be Blue. The DXF Color Table contains 255 entries (1-255).

Option	Action	Default	Description
ApplyViewAngle	0 = No 1 = Yes	0	Apply the view angle from the DXF file (if any) to the coordinates during import. Only applies if the DXF file being imported has a defined view angle.
SkipPaperspace	0 = No, import "paper space" entities 1 = Yes, skip "paper space" entities	0	Skip importing any "paper space" entities in the DXF drawing. "Model space" entities are always imported.
Color	N=R;G;B	See below for default color table	Any color in the DXF color table may be altered by using a ColorN option where N is the color number of the color to be changed. The R, G, and B values specify the color channel saturations for each of the red, green, and blue channels respectively, and each must be between 0 and 255. For example: To set color number 2 to white, the option would be Color2=255;255;255. Multiple ColorN options may be given, one for each color.

The first seven colors in the default Color Table are:

Color #	R;G;B Values	Color

1	255;0;0	Red
2	255;255;0	Yellow
3	0;255;0	Green
4	0;255;255	Cyan
5	0;0;255	Blue
6	255;0;255	Magenta
7	0;0;0	Black

Import Messages

The following messages may appear while attempting to import .DXF files.

Incomplete Entity

Some vital groups are missing from an entity in the DXF file. Make sure the layer and other required groups are present.

Couldn't find a block to insert

The program attempted to insert a block while the latter couldn't be found. Make sure the format of the BLOCKS section is correct, and the appropriate block is available.

Warning: 3-D extrusion not supported

The imported drawing contains one or more extruded objects which may not display properly after import. The DXF import filter software does not support the extrusion of two-dimensional objects to three dimensions within a DXF file. Click *Yes* to import the objects. Objects may appear incorrectly. Click *No* to import the .DXF file without any objects that contain an extrusions.

Esri ArcInfo Export Format [.E00] Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Defaults=1,AreasToCurves=1"
```

This would first set all import options to their default values, then set the *AreasToCurves* option value to one, which would specify that any areas imported be converted to closed curves.

Option	Action	Default	Description
AreasToCurves	0 = No 1 = Yes	0	Convert all polygons to polylines during import.
AllLines	0 = No 1 = Yes	0	Consider all lines.
WhichLines	0 = Import all lines 1 = Import only freestanding lines 2 = Import no lines	0	Specifies which lines from the file are to be imported
WhichNodes	0 = Import all nodes 1 = Import no nodes	0	Specifies whether nodes (points) from the file are to be imported.
WhichAreas	0 = Import all areas 1 = Import no areas	0	Specifies whether ares from the file are to be imported.
WhichText	-2 = Import all text -1 = Import no text N = any other value indicates which specific text group number to import	-2	Specifies which text group from the file is to be imported. For example, use WhichText=3 to import only the text from group 3.

ER Mapper [.ECW] Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

"Scale=16"

This would reduce the scale of the map to 1/16th .

Option	**Action**	**Default**	**Description**
Format	1 = 1-bit color indexed 4 = 4-bit color indexed 8 = 8-bit color indexed 24 = 24-bit true color 32 = 32-bit true color with alpha		Specifies the color depth (or pixel format) of the imported image. The greater the color depth, the more faithfully the image will represent the colors assigned to objects in your document.
Scale	1 = 1/1 (uses most memory, best quality) 2 = 1/2 4 = 1/4 8 = 1/8 16 = 1/16 32 = 1/32 (uses least memory, lowest quality)	1	Since some images can be extremely large once expanded into memory, the import filter allows the image to be reduced in dimensions by 1/2 to 1/32 of the original size.
LRX	integer	maximum X	Use LRX to limit the import to a subregion of the file. LRX is the X pixel coordinate for the lower right corner of the desired subregion.
LRY	integer	maximum Y	Use LRY to limit the import to a subregion of the file. LRY is the Y pixel coordinate for the lower right corner of the desired subregion.
ULX	integer	0	Use ULX to limit the import to a subregion of the file. ULX is the X pixel coordinate for the upper left corner of the desired subregion.
ULY	integer	0	Use ULY to limit the import

			to a subregion of the file. ULY is the Y pixel coordinate for the upper left corner of the desired subregion.

Remarks
The pixel coordinates increase in the X direction from left to right and increase in the Y direction from top to bottom. The pixel coordinate origin is the upper left corner. For example an image with a 2000 pixel width and 3000 pixel height has the following coordinates: the upper left corner is coordinate (0,0) and the lower right corner is the x and y maximums (2000,3000).

However, the image still will import correctly even if the ULY is used for the maximum Y and LRY is used for the minimum Y.

Windows Enhanced Metafile [.EMF] Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Defaults=1,BreakApart=0"
```

This would first set all import options to their default values, then set the BreakApart option value to zero, which specifies the metafile contents are to remain together as a single unit.

Option	Action	Default	Description
BreakApart	0 = No 1 = Yes	1	Break metafile apart into individual graphical objects during import.

Image (Bitmap) Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Defaults=1,TIFImageNum=2"
```

This would set all import options to their default values, then indicate that the second TIFF image from the (assumed) multi-image file be imported.

Option	Action	Default
Defaults=1	Set all options to their default values	No
ForgetOptions=1	Don't remember options for later use	No
TIFImageNum=N	Import image #N from a multi-image TIFF file	1
DCXImageNum=N	Import image #N from a multi-image DCX file	1
Sid_Scale	Reduction factor for MrSID files; a power of two between 1 and 32	
SpatialReferenceSource=0	(None) Ignore all spatial reference info	0
SpatialReferenceSource=1	Use Embedded GeoTIFF Parameters	
SpatialReferenceSource=2	Use Golden Software Reference File	
SpatialReferenceSource=3	Use Esri World File	
SpatialReferenceSource=4	Use Blue Marble .RSF File	

Golden Software Boundary .GSB Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Defaults=1,AreasToCurves=1"
```

This would first set all import options to their default values, then set the *AreasToCurves* option value to one, which would specify that any areas imported be converted to closed curves.

Option	Action	Default
Defaults=1	Set all options to their default values	No

ForgetOptions=1	Don't remember options for later use	No
AreasToCurves=1	Convert area objects to closed curves	No

Golden Software Interchange [.GSI] Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

"Defaults=1, PrimaryIDField=2"

This would set all import options to their default values, and then specify field number 2 is to be used as the primary ID.

Option	Action	Default
Defaults=1	Set all options to their default values	No
ForgetOptions=1	Don't remember options for later use	No
PrimaryIDField=n	Specify that field number n of each attribute ID record will be assigned to the primary ID string of each graphical object that is imported from the interchange file.	0
SecondaryIDField=*n*	Same as above, except applies to the secondary ID.	0

LAS LiDAR Binary File Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

"Defaults = 1, AcceptXMin=3, AcceptXMax=15, AcceptClass[2]=1, AcceptClass[3]=1"

This would first set all options to the default values, specifies a range of x values, then specifies which classes to import.

Option	Action	Default	Description
RejectInconsistent	0 = No 1 = Yes	0	1 to reject inconsistent records, 0 to keep inconsistent records.
AcceptXMin	Value		Minimum X value, greater than or equal to
AcceptXMax	Value		Maximum X value, less than or equal to
AcceptYMin	Value		Minimum Y value, greater than or equal to
AcceptYMax	Value		Maximum Y value, less than or equal to
AcceptZMin	Value		Minimum Z value, greater than or equal to
AcceptZMax	Value		Maximum Z value, less than or equal to
AcceptNthPoint	Value		Returns every Nth point.
AcceptReturn	Value		Filters by laser return value
AcceptClass	0 = No 1 = Yes		0 rejects the specified class, and 1 accepts the specified class. Takes the form "AcceptClass[x]=" where x is class number (0-31)
AcceptAllClasses	0 = No 1 = Yes		1 to accept ALL classes. Overrides AcceptClass specification.
AcceptNoClasses	0 = No 1 = Yes		1 to accept NO classes. Overrides AcceptClass specification.

MapInfo Interchange Format [.MIF] Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Defaults=1,AreasToCurves=1"
```

This would first set all import options to their default values, then set the *AreasToCurves* option value to one, which would specify that any areas imported be converted to closed curves.

Option	**Action**	**Default**
Defaults=1	Set all options to their default values	No
ForgetOptions=1	Don't remember options for later use	No
AreasToCurves=1	Convert area objects to closed curves	No
IgnoreStyles=1	Import as base map (ignore styles, colors and fill)	No
PrimaryIDField=*n*	Specify that field number n of each record in the optional MID database will be assigned to the primary ID string of each object that is imported from the MIF input file. If the MIF file is not accompanied by a MID file, this option has no effect.	0
SecondaryIDField=*n*	Same as above, except applies to the secondary ID.	0

PDF Adobe Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Resolution=150, WhichPage=7"
```

This would set the resolution of the images in the PDF file to 150 DPI and imports only page 7.

Option	**Action**	**Default**	**Description**
WhichPage	0 = all pages *n* = specific page number	0	The page number of the page to import. 0 imports all pages. Type the specific page number

			to import only that page.
Resolution	Value from 50 to 1200	150	The resolution of the imported PDF in DPI.
DoVector	0 = False 1 = True	1	Set to 1 to import vector graphics. Set to 0 to ignore vector graphics.
DoRaster	0 = False 1 = True	1	Set to 1 to import raster graphics. Set to 0 to ignore raster graphics.
UseAltPdfPlugIn	0 = False 1 = True	0	Set to 1 to use the alternate rasterizer for raster import. Set to 0 to use the default rasterizer for raster import.

Golden Software PlotCall [.PLT] Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Defaults=1,Pen3=0;0;255;1;0.05"
```

This would first set all import options to their default values, then set the parameters for lines which are drawn with Pen #3. The lines will be Blue, dashed and 0.05 inches wide.

Option	Action	Default
Defaults=1	Set all options to their default values	No
ForgetOptions=1	Don't remember options for later	No

	use	
PenN=R;G;B;S;W;N	Lines drawn with Pen #N are: Red intensity "R" (0-255) Green intensity "G" (0-255) Blue intensity "B" (0-255) Style "S" (See below) Width "W" inches Contain "N" custom segments	See below 0

PlotCall files can specify up to 16 pens (1-16). The default width is 0.0 (thinest line possible but still visible). The default line attributes associated with each pen are shown in the following table:

Pen #	**R;G;B Values**	**Color**	**Style**
1	0;0;0	Black	0 (Internal Solid)
2	0;0;255	Blue	0 (Internal Solid)
3	0;255;0	Green	0 (Internal Solid)
4	0;255;255	Cyan	0 (Internal Solid)
5	255;0;0	Red	0 (Internal Solid)
6	255;0;255	Magenta	0 (Internal Solid)
7	255;255;0	Yellow	0 (Internal Solid)
8	255;255;255	White	0 (Internal Solid)
9	0;0;0	Black	1 (Internal Dashed)
10	0;0;255	Blue	1 (Internal Dashed)
11	0;255;0	Green	1 (Internal Dashed)
12	0;255;255	Cyan	1 (Internal Dashed)
13	255;0;0	Red	1 (Internal Dashed)
14	255;0;255	Magenta	1 (Internal Dashed)
15	255;255;0	Yellow	1 (Internal Dashed)
16	255;255;255	White	1 (Internal Dashed)

The different line styles are:

Style	**Line**
-1	Custom (See below)
0	Internal Solid

1	Internal Dashed
2	Internal Dotted
3	Internal Dash-Dot
4	Internal Dash-Dot-Dot

Internal Style
The five internal styles indicate a generic style and leave it to the display device to decide how best to render the line.

Custom Style
A custom style allows (and requires) you to specify the length of the strokes and gaps used when rendering the line.

Esri Shapefile [.SHP] Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Defaults=1,AreasToCurves=1"
```

This would first set all import options to their default values, then set the *AreasToCurves* option value to one, which would specify that any areas imported be converted to closed curves.

Option	Action	Default
Defaults=1	Set all options to their default values	No
ForgetOptions=1	Don't remember options for later use	No
AreasToCurves=1	Convert area objects to closed curves	No
PrimaryIDField=*n*	Specify that field number *n* of each record in the optional DBF database will be assigned to the primary ID string of each object that is imported from the SHP input file. If the SHP file is not accompanied by a DBF file, this option has no effect.	0
SecondaryIDField=	Same as above, except applies to	0

n	the secondary ID.

LizardTech MrSID .SID Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

"Scale=16"

This would reduce the scale of the image to 1/16th .

Option	Action	Default	Description
Format	1 = 1-bit color indexed 4 = 4-bit color indexed 8 = 8-bit color indexed 24 = 24-bit true color 32 = 32-bit true color with alpha		Specifies the color depth (or pixel format) of the imported image. The greater the color depth, the more faithfully the image will represent the colors assigned to objects in your document.
Scale	1 = 1/1 (uses most memory, best quality) 2 = 1/2 4 = 1/4 8 = 1/8 16 = 1/16 32 = 1/32 (uses least memory, lowest quality	1	Since some images can be extremely large once expanded into memory, the import filter allows the image to be reduced in dimensions by 1/2 to 1/32 of the original size.
LRX	integer	maximum X	Use LRX to limit the import to a subregion of the file. LRX is the X pixel coordinate for the lower right corner of the desired subregion.
LRY	integer	maximum Y	Use LRY to limit the import

			to a subregion of the file. LRY is the Y pixel coordinate for the lower right corner of the desired subregion.
ULX	integer	0	Use ULX to limit the import to a subregion of the file. ULX is the X pixel coordinate for the upper left corner of the desired subregion.
ULY	integer	0	Use ULY to limit the import to a subregion of the file. ULY is the Y pixel coordinate for the upper left corner of the desired subregion.

Remarks

The pixel coordinates increase in the X direction from left to right and increase in the Y direction from top to bottom. The pixel coordinate origin is the upper left corner. For example an image with a 2000 pixel width and 3000 pixel height has the following coordinates: the upper left corner is coordinate (0,0) and the lower right corner is the x and y maximums (2000,3000).

However, the image still will import correctly even if the ULY is used for the maximum Y and LRY is used for the minimum Y.

TIF Tagged Image File Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

"Defaults=1,CustomNoData=1,CustomNoDataValue=-32767"

This would first set all import options to their default values, then use a custom NoData value for the grid file.

Option	Action	Default	Description
EnableCustomNoData	0 = No 1 = Yes	0	0 to use the NoData value specified in the TIF file header. 1 to specify a custom NoData value.

CustomNoDataValue	N		Specify the NoData value for the TIF file.
AutoContrast	0 = No 1 = Yes	1	0 to import the raster data TIFF Z values directly. 1 to increase contrast by remapping values from 0 - 255.

Remarks
These import automation options are only used when importing the TIF file as a grid, for example with AddContourGridMap or AddContourGridMapGraph. There are no import options when importing a TIF image, e.g. with Import.

Windows Metafile .WMF and .EMF Import Automation Options

Since the **Import Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
"Defaults=1,BreakApart=0"
```

This would first set all import options to their default values, then set the BreakApart option value to zero, which specifies the metafile contents are to remain together as a single unit.

Option	Action	Default	Description
BreakApart	0 = No 1 = Yes	1	Break metafile apart into individual graphical objects during import.

Microsoft Excel Import Automation Options

If there are multiple sheets in an Excel workbook, **Grapher** prompts you to choose one sheet when opening or importing Excel files. Since the **Worksheets Found** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

```
"Sheet=XX"
```

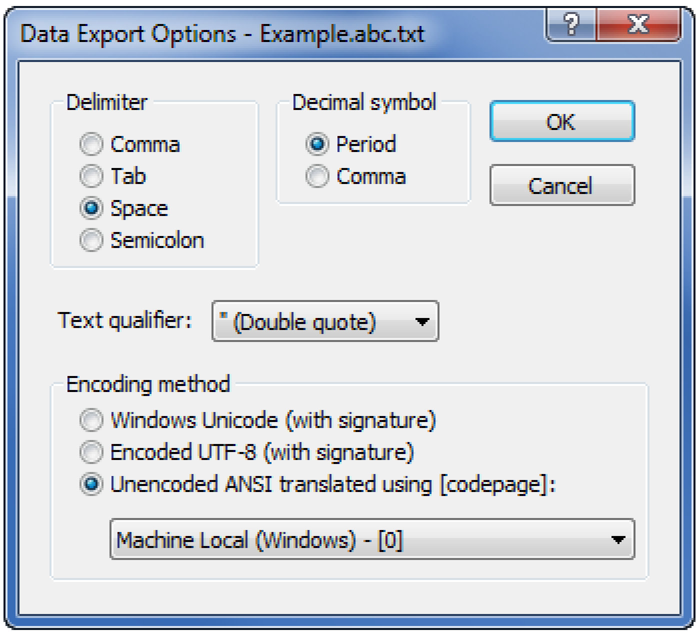
Where XX is the name of the Excel sheet to open.

Option	Action	Default
Sheet	Select which sheet in an XLS file to open	open first sheet if a sheet is not specified

Export Options

Data Export Options

When a file is saved in the .DAT format, the **GSI Data Export Options** dialog is displayed with the following options:



Choose the Delimiter *and* Text Qualifier *for .DAT files in the**Data Export Options**dialog.*

Delimiter

Delimiters are the characters used between cells in a single row (fields in a record), Select *Comma, Tab, Space,* or *Semicolon* from the *Delimiter* list.

Decimal Symbol

Decimal symbol is the symbol used as the decimal point. This can be a comma or period. This option is only available with .TXT files.

Text Qualifier

Select *" (Double quote), ' (Single quote),* or *(none)* from the *Text qualifier* drop-down list. Left-click the down arrow to display the drop-down list. The selected text qualifier will determine how non-numeric or mixed alpha-numeric cell entries are identified in the .DAT file. For example, if *" (Double quote)* is selected, all non-numeric or mixed alphanumeric cell entries are surrounded by double quotes in the file.

Encoding Method

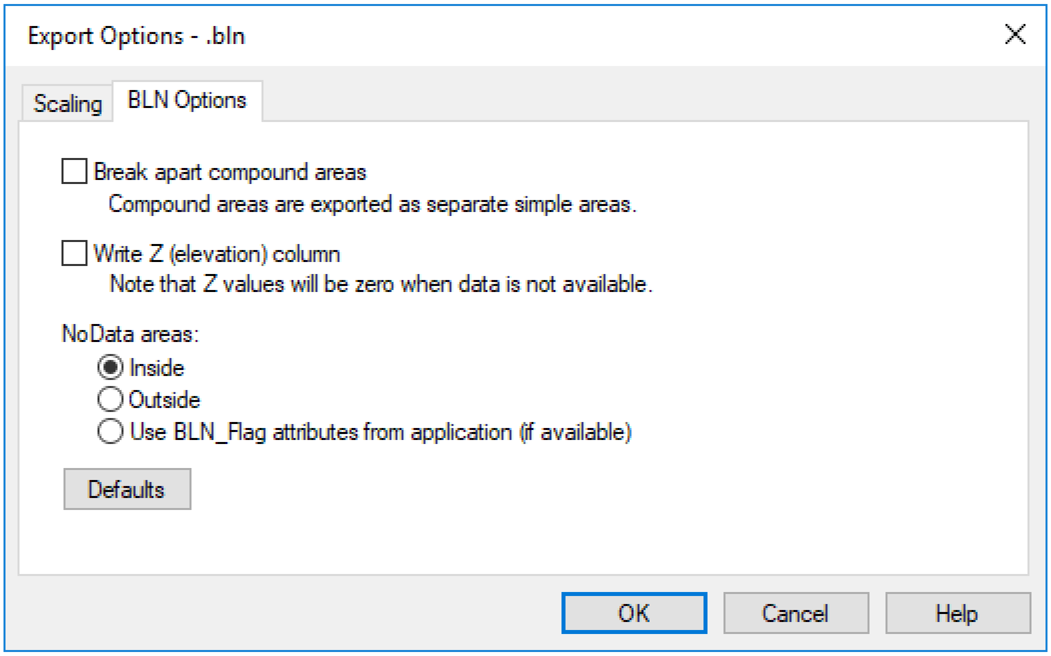
The *Encoding method* section allows the choice of *Windows Unicode* data, *Encoded UTF-8* data, or *Unencoded ANSI translated using* data when exporting or saving an ASCII data file. *Windows Unicode* and *Encoded UTF-8* data are often referred to as international data. It would include character sets from Russia, Israel, China, Greece, Hungary, among others. If the data does not appear correctly in the exported file, the *Encoding method* may be specified incorrectly.

ANSI encoding contains characters within the first 256 characters of a font. These are normally in English. After selecting *Unencoded ANSI translated using [codepage]*, select the *codepage* from the list that will read the data correctly.

Golden Software Blanking .BLN Export Options Dialog

The **Export Options** dialog allows you to specify options which determine how information in the file is exported.

When exporting, the application specifies coordinates in *Page Units* (inches or centimeters) as indicated on the document rulers. You may want these values offset and/or scaled back to original map coordinates in the Golden Software Blanking .BLN file. The scaling options can be changed on the Scaling tab.



*Specify the BLN export options in the **Export Options** dialog.*

Break Apart Compound Areas

Choose *Break apart compound areas* to have compound areas (those containing islands or lakes) output as separate area entities. This option should be chosen if the .BLN file is to be used as a boundary file. Do not choose this option if the .BLN file is to be used as a blanking file.

Write Z (elevation) column

Grapher does not associate Z values with objects. The third column will always contain 0 when *Write Z (elevation)* column is checked. Check the *Write Z (elevation) column* check box to export the .BLN file with the Z values. If ZLEVEL values are not available for the object, 0 will be written in the Z column.

NoData Areas

The *NoData areas* section contains the option to set the BLN file blanking flag to either assign NoData values inside or outside. Select the appropriate option. With a simple BLN file with a single polygon, the blanking flag is located in cell B1. A zero (0) is displayed when assigning the NoData value outside the area and a one (1) is displayed when assigning the NoData value inside the area. The *NoData areas* option sets the blanking flag for all polygons in the BLN file.

Polygons do not have associated attributes in **Grapher**. When *Use BLN_ Flag attributes from application (if available)* is selected, the blanking flag is set to 1 for assign NoData inside.

Defaults

The *Defaults* button sets all options to default conditions.

Scaling Page

When exporting, the application specifies coordinates in Page Units (inches or centimeters) as indicated on the document rulers. You may want these values offset and/or scaled back to original map coordinates in the Golden Software Blanking (BLN) file.

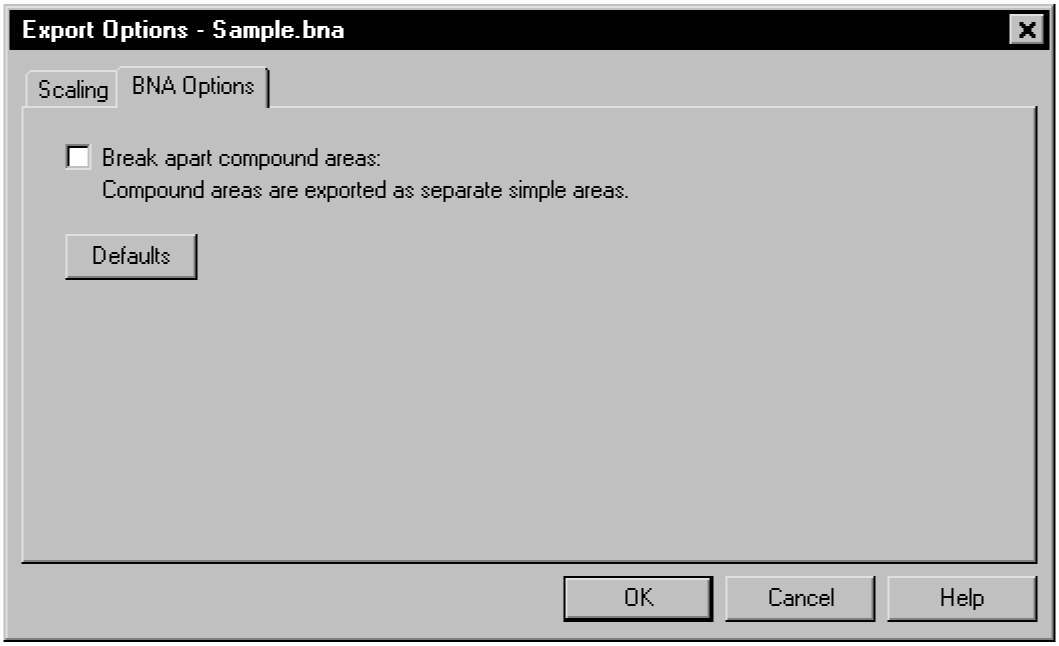
This is accomplished by specifying the corner points of a rectangle (in Page Units) in the application document and the corner points of a rectangle in the desired BLN file units. The document coordinates will be offset and/or scaled so the corner points of the document rectangle will have the desired BLN coordinates. Checking Save scaling info will cause the scaling information to be stored for future use.

Scaling information can be retrieved from two sources. *Saved* will reload previously saved values. *Application* will load scaling info calculated by the application. The application provides potentially useful scaling info whenever possible. If the application detects an unrotated 3-dimensional map object that is viewed from directly overhead (i.e., it’s really a 2-D map object) and that map object is the only object being exported, it retrieves the (X,Y) data extents from the map and makes those the BLN scaling rectangle. Otherwise, the application sets the scaling rectangles so the BLN coordinates will be the same as the document page units.

See the Scaling Page for detailed information.

Atlas Boundary .BNA Export Options Dialog

The **Export Options** dialog allows you to specify options which determine how information in the file is exported.



*The **Export Options** dialog controls the BNA export options.*

Break Apart Compound Areas

Check the *Break apart compound areas* option to export compound areas as separate simple areas.

Scaling Page

When exporting, the application specifies coordinates in Page Units (inches or centimeters) as indicated on the document rulers. You may want these values offset and/or scaled back to original map coordinates in the Atlas Boundary (BNA) file.

This is accomplished by specifying the corner points of a rectangle (in Page Units) in the application document and the corner points of a rectangle in the desired BNA file units. The document coordinates will be offset and/or scaled so the corner points of the document rectangle will have the desired BNA coordinates. Checking *Save scaling info* will cause the scaling information to be stored for future use.

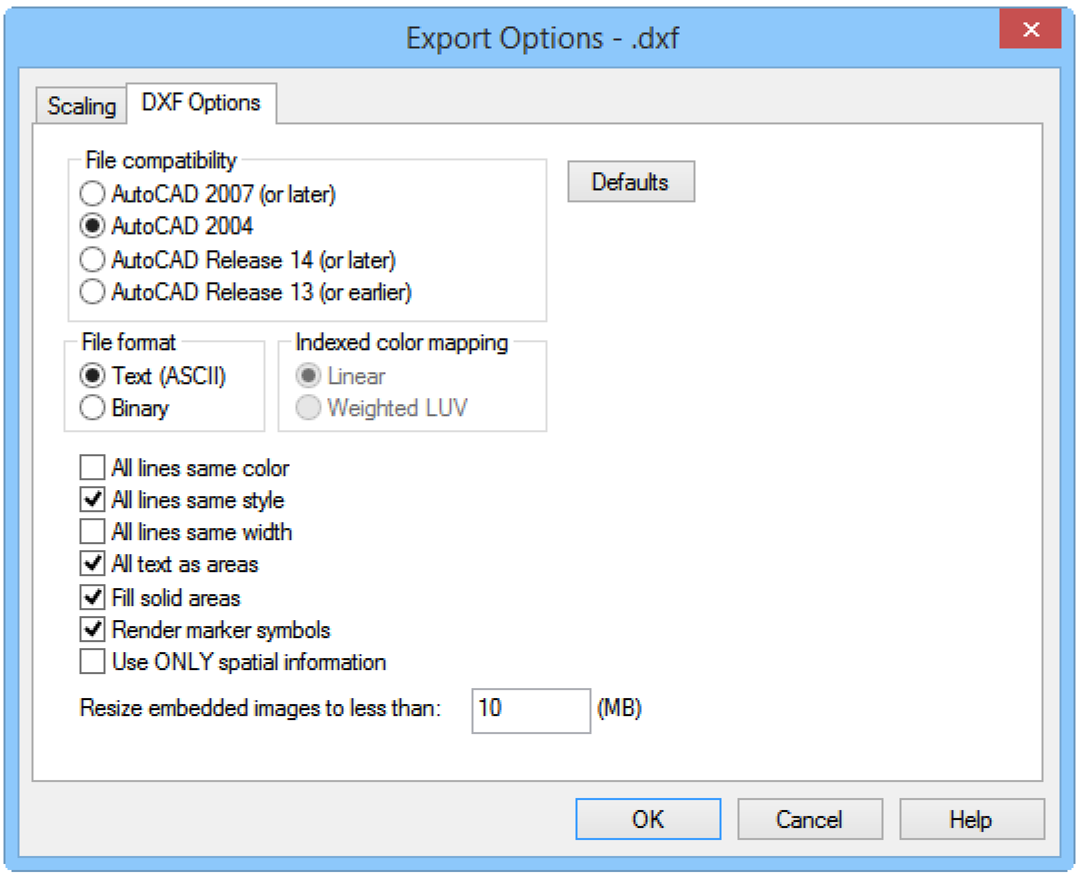
Scaling information can be retrieved from two sources. *Saved* will reload previously saved values. *Application* will load scaling info calculated by the application. The application provides potentially useful scaling info whenever possible. If the application detects an unrotated 3-dimensional map object that is viewed from directly overhead (i.e., it's really a 2-D map object) and that map object is the only object being exported, it retrieves the (X,Y) data extents from the map and makes those the BNA scaling rectangle. Otherwise, the application sets the scaling rectangles so the BNA coordinates will be the same as the document page units.

The *Defaults* button sets all buttons and check boxes to default conditions. The scaling rectangles will, in turn, be reloaded with values from the default scaling source.

See the Scaling Page for detailed information.

AutoCAD DXF Export Options Dialog

The **Export Options** dialog allows you to specify options which determine how information in the file is exported.



*Customize DXF export options in the **Export Options** dialog, **DXF Options** page.*

File Compatibility

Select the appropriate file compatibility. Available options are *AutoCAD 2007 (or later), AutoCAD 2004, AutoCAD Release 14 (or later),* and *AutoCAD Release 13 (or earlier)*.

AutoCAD 2007 (or later)

Choose *File compatibility* of *AutoCAD 2007 (or later)* if the DXF file needs to be imported into AutoCAD 2007 or later. The 2007 version supports Unicode character encoding in the UTF-8 format.

AutoCAD 2004

Choose *File compatibility* of *AutoCAD 2004* if the DXF file needs to be imported into AutoCAD 2004 or later. The 2004 version supports Unicode character encoding in the \U+XX format. The 2004 version (and all newer versions) also support RGB color support.

AutoCAD Release 14 (or later)

Choose *File compatibility* of *AutoCAD Release 14 (or later)* if the DXF file needs to be imported into AutoCAD Release 14 or later. The version 14 and previous versions support indexed color mapping.

AutoCAD Release 13 (or earlier)

Choose *File compatibility* of *AutoCAD Release 13 (or earlier)* if the DXF file needs to be imported into an earlier release of AutoCAD.

File Format

Choose *Text (ASCII)* or *Binary* to specify the format of the exported DXF file. See the AutoCAD DXF File Description for information on the organization of DXF files.

Indexed Color Mapping

Select the *Linear* or *Weighted LUV* option when either *AutoCAD Release 14 (or later)* or *AutoCAD Release 13 (or earlier)* is selected as the *File compatibility.* Note: Even though the older file formats can be imported into AutoCAD Release 14 and AutoCAD 2004 or later, the AutoCAD Release 14 or later file format uses several features that result in smaller, faster loading DXF files, and AutoCAD 2004 or later supports true color in addition to the indexed color.

All Lines Same Color

Choose *All lines same color* if you don't want an AutoCAD color number (1-255) assigned to each of your lines. The default color for the layer will be used instead. All exported graphical entities are assigned to a layer named GSLAYER.

All Lines Same Style

Choose *All lines same style* if you want exported lines to be assigned the default style (for the GSLAYER) when imported into **AutoCAD**. Otherwise, exported lines will retain their style (solid, dashed, etc.).

All Lines Same Width

Choose *All lines same width* if you want exported lines to be assigned the default width (for the GSLAYER) when imported into **AutoCAD**. Otherwise, exported lines will be the width assigned in the application document.

All Text As Areas

Text can be exported as DXF solid polygons (*All text as areas* checked). These polygons will always be oriented properly. Whether or not these solid polygons (like all solid polygons) will be filled or not is controlled by the *Fill solid areas* option (see below).

Text can also be exported as **AutoCAD** text entities (*All text as areas* unchecked). No matter what typeface is specified in the application document, all text entities are assigned **AutoCAD's** STANDARD font. Once inside **AutoCAD**, the text entities can be edited in the normal **AutoCAD** fashion. As long as there is no shear, perspective, or clipping, DXF text entities will be exported as text. This means that the DXF text entities will be sized and oriented similar to the text objects in the application document. When shear, perspective, or clipping occur, the text is exported as solid polygons. Shear occurs when the character glyphs are not perpendicular to the text baseline. Perspective occurs when the height of glyphs in the text string are not all the same, as in a 3-D view where the glyphs are smaller the farther they are from the observer. Clipping occurs when part of the text object is partially inside and partially outside the map limits.

Fill Solid Areas

Choose *Fill solid areas* if you want the interior of solid areas (polygons) to be filled. Otherwise, the areas will be exported as AutoCAD CLOSED POLYLINE entities.

Render Marker Symbols

Check the *Render marker symbols* check box if the marker symbols should be exported to the DXF file. The marker symbols are exported as lines and polygons. When the *Render marker symbols* option is not checked, marker symbols are exported to the DXF file as points.

Use ONLY Spatial Information

Choose *Use ONLY spatial information* if you want to export only spatial information and not object attributes or text labels. Spatial information is only concerned with the location of objects in space (i.e., their coordinates) and not with their attributes (such as line or fill style, marker symbol used, text labels, etc.) For example, if this option is chosen, all text will be ignored, markers will be exported as point entities instead of polygonal glyphs and coordinates output to the DXF file will be stored in map units instead of inches. This is useful when exporting base maps when only the spatial information is desired.

The AutoCAD program's behavior when importing DXF files (via the DXFIN command) is different depending on whether the **AutoCAD** drawing file .DRW is brand new or already contains drawing entities. If the file is brand new, attributes (such as line style) are loaded from the Tables section, so lines encountered in the Entities section will have the proper line style (solid, dash, dash-dot, etc.). However, if an old drawing file is already open, **AutoCAD** will ignore the Tables section and only read the Entities section. If the DXF file contains lines with styles not already defined, **AutoCAD** will issue an error message and abort the DXF import. It is recommended you choose the All lines same style option when exporting DXF files that will be imported into existing **AutoCAD** drawings. **AutoCAD** will then assign the default style to all lines in the imported layer (named GSLAYER).

Resize Embedded Images to Less Than

The *Resize embedded images to less than* option specifies the maximum size (in megabytes) an embedded image is allowed to be. If an exported image exceeds this size, its resolution will be reduced so it doesn’t exceed the designated maximum size. Increase this value to get better looking images at the expense of larger export files.

Defaults

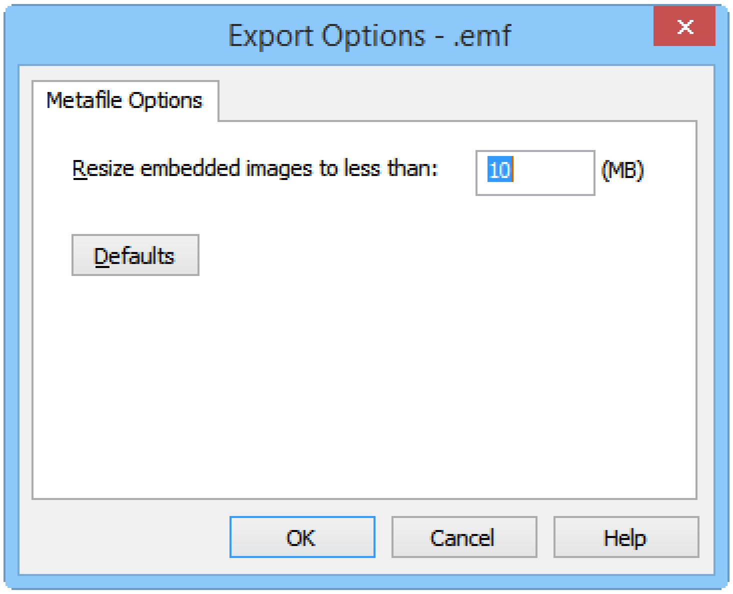
The *Defaults* button sets all buttons and check boxes to default conditions.

Scaling Page

See the Scaling Page for detailed information.

Windows Enhanced Metafile .EMF Export Options Dialog

The **Export Options** dialog allows you to specify options which determine how information in the file is imported. A Windows Enhanced Metafile .EMF is a collection of objects combined together to produce an image.



Specify the EMF file export options in the ***Export Options*** *dialog.*

Resize Embedded Images

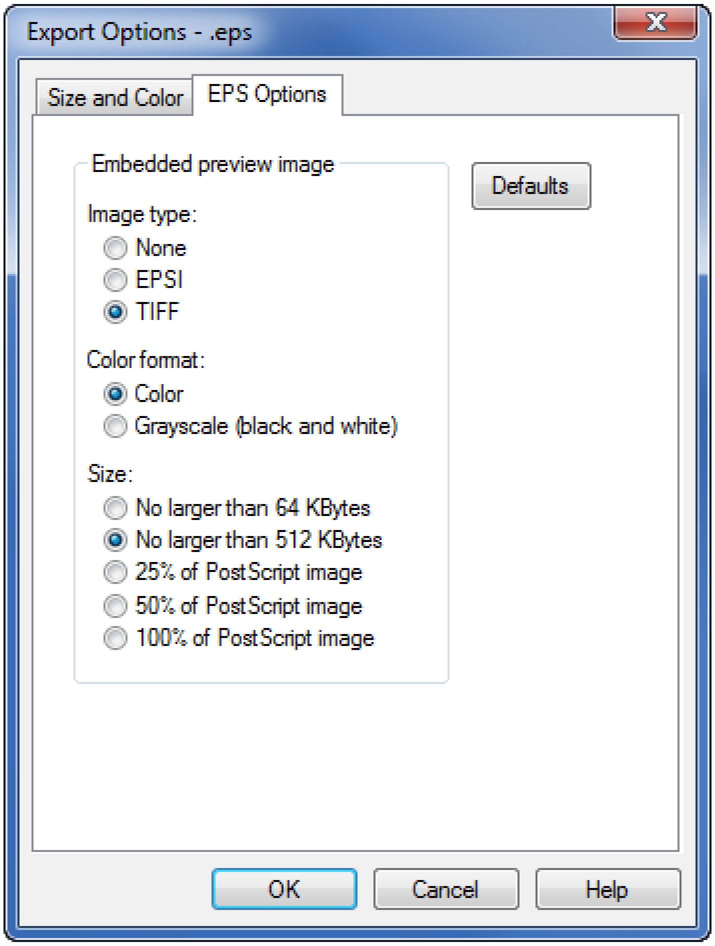
The *Resize embedded images to less than* option specifies the maximum size (in megabytes) an embedded image is allowed to be. If an exported image exceeds this size, its resolution will be reduced so it doesn’t exceed the designated maximum size. Increase this value to get better looking images at the expense of larger export files.

Defaults

The *Defaults* button sets all options to default conditions.

Encapsulated PostScript .EPS Export Options Dialog

The **Export Options** dialog allows you to specify options which determine how information in the file is exported.



Specify the EPS options in the ***EPS Options*** *page of the* ***Export Options*** *dialog.*

Image Type

The *Image type* controls determine how the EPS preview image is encoded in the export file. Possible selections are *EPSI, TIFF*, or *None.* Choosing *EPSI* or *TIFF* inserts an image into the beginning of the EPS file. Selecting *None* inserts no preview image. Some programs need the preview image in the file so that the file imports correctly.

Color Format

The *Color format* controls determine whether the preview image is exported in *Color* or *Grayscale (black and white)*. Setting the *Color format* to *Grayscale (black and white)* does not affect the colors in the EPS file. On the image preview colors are changed.

Size

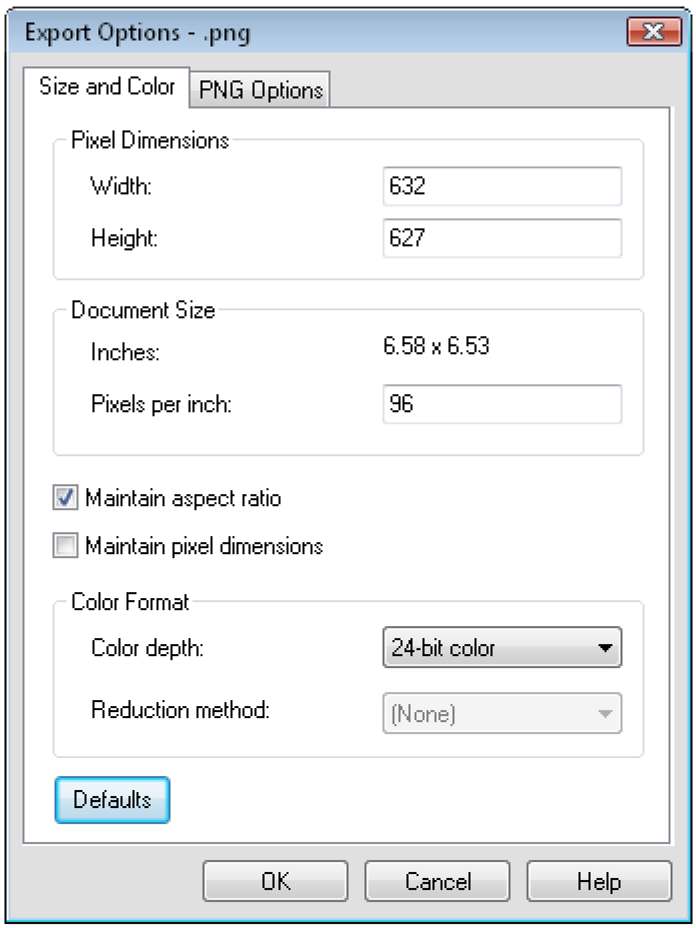
The *Size* controls determine what size of EPS preview image is encoded in the export file. The selections are *No larger than 64 KBytes, No larger than 512 Kbytes, 25% of PostScript Image, 50% of PostScript Image,* or *100% of PostScript Image.* Selecting a smaller size will give less precision on the image preview, but will not affect the EPS file.

Default

Click the *Default* button to return the EPS options to the default settings.

Export Options Dialog - Size and Color Page

All image export formats have a **Size and Color** page in the **Export Options** dialog.



*The **Size and Color** page of the **Export Options** dialog controls options for image export.*

Pixel Dimensions

Choose the *Width* and *Height* pixel settings for the image. The *Pixel dimensions* indicates the number of pixels that are in the exported image. The larger the number of pixels, the larger the output image will be.

Document Size

The *Inches* displays the current selected image size in inches. The image size is updated when the *Pixel Dimensions* are adjusted. The size in inches is determined by dividing the number of *Pixel Dimensions* by the *Pixels per inch* and rounding to the hundredths.

When the *Pixel Dimensions* have not been changed, the *Inches* is approximately equal to the size of the objects being exported. To determine this size, click once on the object to select it or select all objects that are being exported. The status bar will list the size of the selected objects.

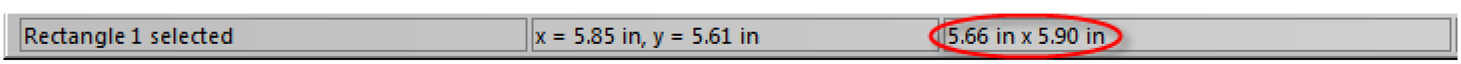
Pixels Per Inch

Choose the *Pixels per inch* to increase or decrease the resolution of the image being exported. If you choose to change the number of *Pixels per inch*, the *Width* and *Height* in the *Image Dimensions* change accordingly. The *Pixels per inch* control how fine a resolution the output image will have. The larger the number of *Pixels per inch*, the larger the *Pixel Dimensions* will be.

The *Pixels per inch* is set to 72 for all GIF images and cannot be changed. GIF images are always 72 DPI, by definition. For higher quality images, it is suggested that PNG, TIF, or BMP be used instead of GIF.

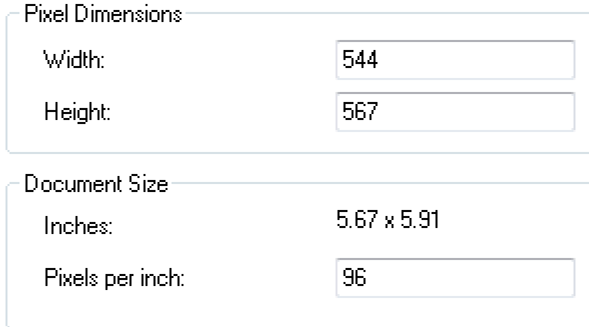
Example

For example, a rectangle is selected. The status bar reports that the size of the map is 5.66 in x 5.90 in.



The status bar shows the size of the objects being exported.

When this object is exported, the **Size and Color** tab shows the *Nominal image size* as 5.67 by 5.91 inches, as long as the *Pixels per inch* are sufficient to produce this size of image. Note that this is slightly larger, to allow a slight buffer around all objects.



The Inches *is approximately equal to the page size of the objects being exported.*

Maintain Aspect Ratio

Check the *Maintain aspect ratio* box if you want the image to maintain an equal horizontal and vertical resolution. When unchecked, the output image may appear stretched in one of the directions.

Maintain Pixel Dimensions

Check the *Maintain pixel dimensions* box to export the image at the selected *Width* and *Height*, but with a different number of *Pixels per inch*. This results in the same number of pixels, but a different *Document Size*.

Color Format

The *Color Format* gives you the option to output your image with *Color depth.* The greater the color depth, the more faithfully the image will represent the colors assigned to objects in your document. Different output formats support different color depths. Some output formats support 256 colors only, while others also support True Color (16 million colors).

Select one of the options from the *Color Depth* drop-down list. The options are: *8-bit grayscale*, *16-bit grayscale*, *32-bit grayscale*, .*1-bit color indexed*, *4-bit color indexed*, *8-bit color indexed*, or *24-bit true color*.

For example, Windows .BMP format supports *Monochrome*, *16 colors*, *256 colors* and *True Colo*r. Greater color depth will yield a better-looking image, but at the expense of requiring more memory and disk space to hold the image.

Reduction Method

If you select a color indexed *Color Depth*, you can choose a *Reduction Method*. Select one of the options from the *Reduction Method* list. The options are: *Ordered Dither*, *Diffuse Dither*, *Popularity*, *MedianCut555*, or *MedianCut888*.

If a *Color depth* of 256 or fewer colors is selected, you may specify the type of *Dithering* and the type of *Quantization* that is used to reduce the application's image to the selected number of colors.

Dithering determines how similar colors are distributed among clusters of pixels in the reduced image. Possible selections are *Diffuse* which uses a pseudo-random pattern, *Ordered* which uses a repeating pattern, or *None* which disables dithering.

Quantization determines how the colors for the exported image are selected from the palette of 16 million possible colors. Possible selections are *Popularity* which uses the most frequently occurring colors in the image, and *Median* which selects colors based on the 'median cut' method that tries to select the most even distribution of colors over the range of colors that appear in the image. The *Median* method can use either 5, 6, or 8 bits of sample data for each of the three color planes in the image, and the corresponding selections are *5:5:5 Median*, *6:6:6 Median*, and *8:8:8 Median*. Larger sample sizes require more memory to perform the conversion for export, so the smallest sample size that produces an acceptable image is recommended.

Defaults

Click the *Defaults* button to return the export options to the default selections.

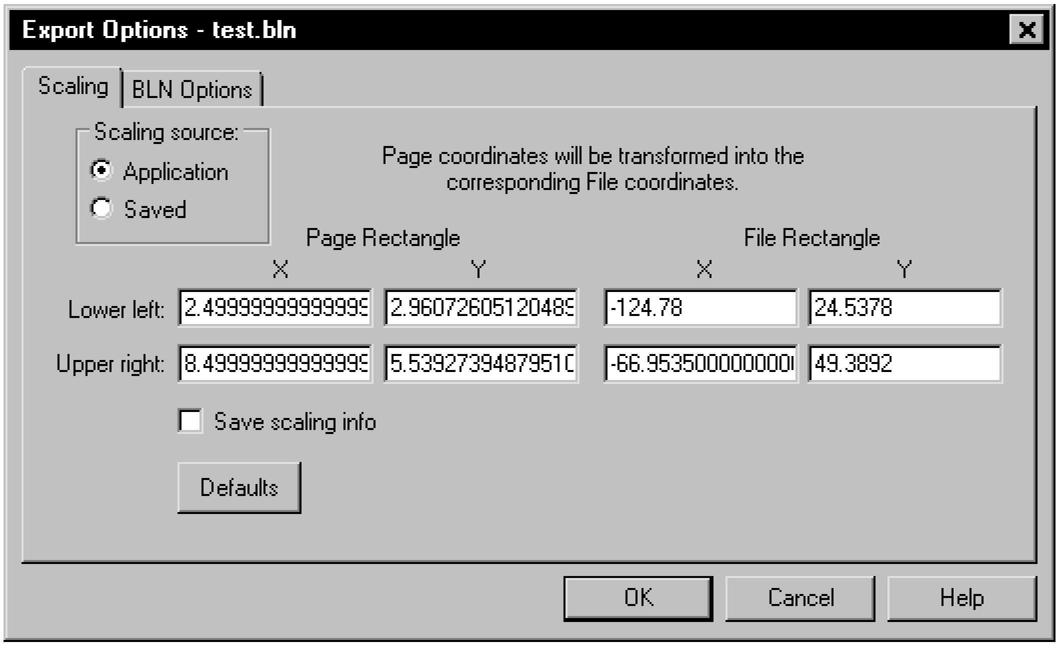
Transparency

Checking the transparency options on the PNG Options tab, the GIF Options tab, or the TIF Options tab can result in an error message when exporting if the *Color depth* option or *Reduction method* does not allow transparency. Click *OK* on the error and change the *Color depth* to 4-bit, 8-bit, or 32-bit for PNG or TIF images. For either PNG or GIF images, change the *Reduction method* to MedianCut555, MedianCut888, or Popularity.

Transparent TIFF images in 4-bit and 8-bit modes use TIFF tag number 42113 (a.k.a. GDAL_NODATA) which is not yet widely supported by other applications. In applications that don't support this tag, the images appear with an opaque background (no transparency). If the application shows an opaque background where a transparent background should appear, re-export the file with 32-bit color depth. Most programs support transparent TIF files with 32-bit colors.

Export Options Dialog - Scaling Page

Many of the file formats have a **Scaling** page in the **Export Options** dialog.



Specify scaling options on the ***Scaling*** *page of the* ***Export Options*** *dialog.*

Scaling Source

Scaling information can be retrieved from two sources: *Application,* and *Saved*. **Grapher** provides potentially useful scaling info whenever possible. If the application detects a 3-dimensional object, the application sets the scaling rectangles so the coordinates will be the same as the document page units.

Application

Application will load scaling info calculated by the application.

Saved

Saved will reload previously saved values.

Rectangle

Rectangle scaling is accomplished by specifying the corner points of a rectangle (in Page Units) in the application document and the corner points of a rectangle in the desired file units. The document coordinates will be offset and/or scaled so the corner points of the document rectangle will have the desired coordinates.

The *Page Rectangle*lists two points on the page in the page coordinates. The*File Rectangle*lists the same two points on the page in the map coordinates.

Save Scaling Info

Checking *Save scaling info* will cause the scaling information to be stored for future use.

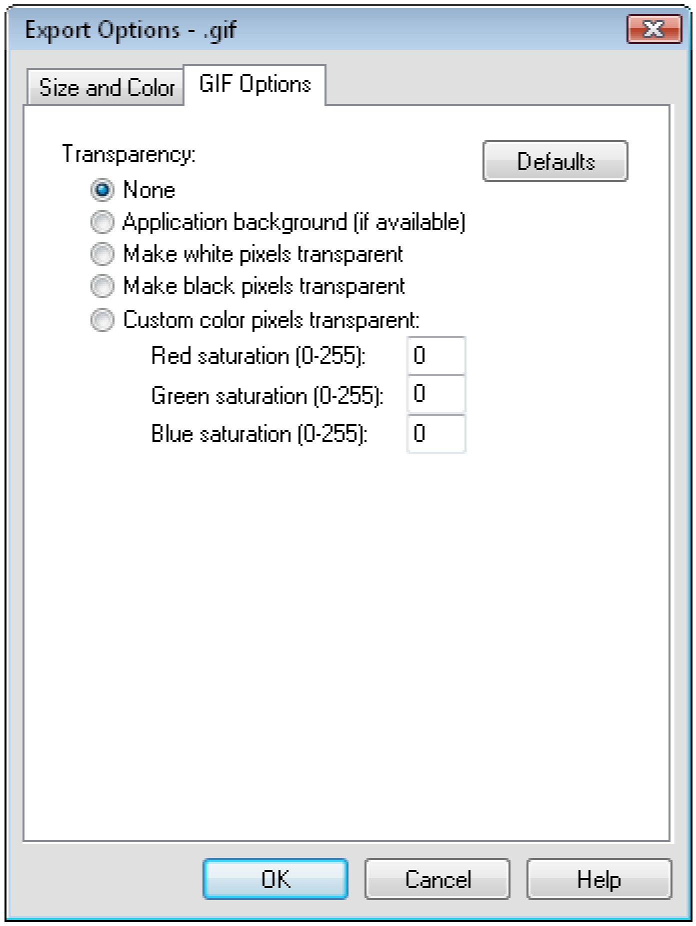
Defaults

The *Defaults* button sets all buttons and check boxes to default conditions. The scaling rectangles will, in turn, be reloaded with values from the default scaling source.

GIF Export Options Dialog

The Graphics Interchange Format .GIF is an image format that was introduced by CompuServe in 1987 and has since come into widespread usage on the World Wide Web due to its wide support and portability. GIF files support transparency.

Use the **Export Options** dialog to specify the Size and Color options and the transparency options for the .GIF file. To export the .GIF file with transparency, click on the **GIF Options** tab in the **Export Options** dialog.



Specify the transparency setting on the ***GIF Options*** *page in the* ***Export Options*** *dialog.*

Transparency

Select *None* to export the image with no transparency.

Select *Application background (if available)* option to export any background areas as transparent. The .GIF file will have transparent background areas. All drawn parts in the plot window are exported solid.

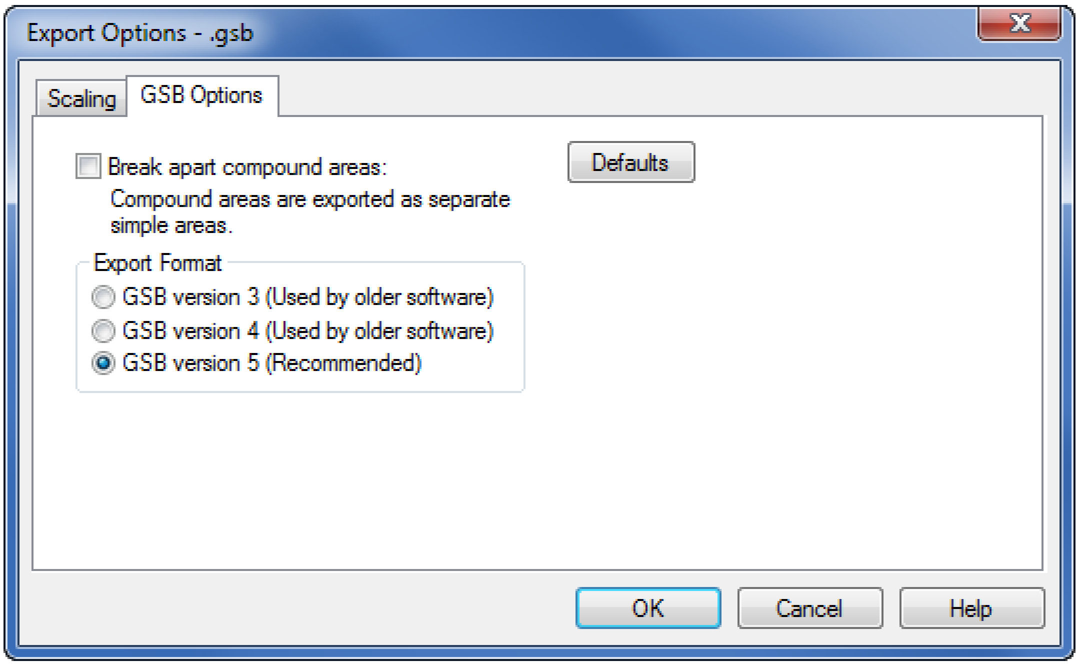
Select *Make white pixels transparent* to make all white areas of the image transparent. Select *Make black pixels transparent* to make all black areas of the image transparent. Select *Custom color pixels transparent* to select a specific color by *Red saturation (0-255)*, *Green saturation (0-255)*, and *Blue saturation (0-255)* in the image to be transparent. When any of these options are selected, pixels with this color in the foreground of the image can be transparent.

Resolution

The *Pixels per inch* is set to 72 for all GIF images and cannot be changed. GIF images are always 72 DPI, by definition. For higher quality images, it is suggested that PNG, TIF, or BMP be used instead of GIF.

Golden Software Boundary .GSB Export Options Dialog

The **Export Options** dialog allows you to specify options which determine how information in the file is exported.



Select the GSB export options in the ***Export Options*** *dialog.*

Break Apart Compound Areas

Check the *Break apart compound areas* option to export compound areas as separate simple areas.

Export Format

- Choose *GSB version 3* or *GSB version 4* if you require an export file that can be imported by certain older versions of Golden Software application software.
- Otherwise, choose *GSB version 5*.

Defaults

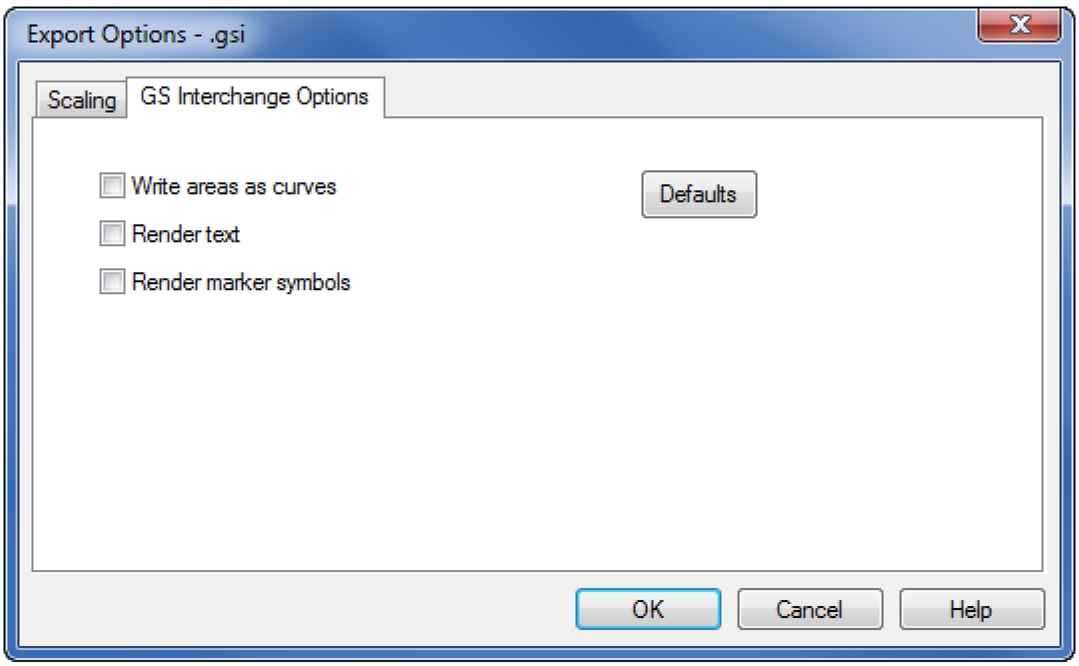
The *Defaults* button sets all controls to default conditions.

Golden Software Interchange .GSI Export Options Dialog

The **Export Options** dialog allows you to specify options which determine how information in the file is exported.

Transparency and Fill

All lines, fills, text, images, and vector objects with transparency are exported and imported with the transparency. Objects with bitmap fills are imported and exported with the fill and transparency. Objects with gradient fill are exported and imported with the gradient fill.



Select the GSI export options in the ***Export Options*** *dialog.*

Write Areas to Curves

Check *Write areas as curves* to cause all area (polygonal) objects to be exported as curve (polyline) objects.

Render Text

Check *Render text* to cause all text objects to be exported as areas and lines. When *Render text* is unchecked, text is exported as text. This means that the GSI text entities will be sized and oriented similar to the text objects in the application document.

Render Marker Symbols

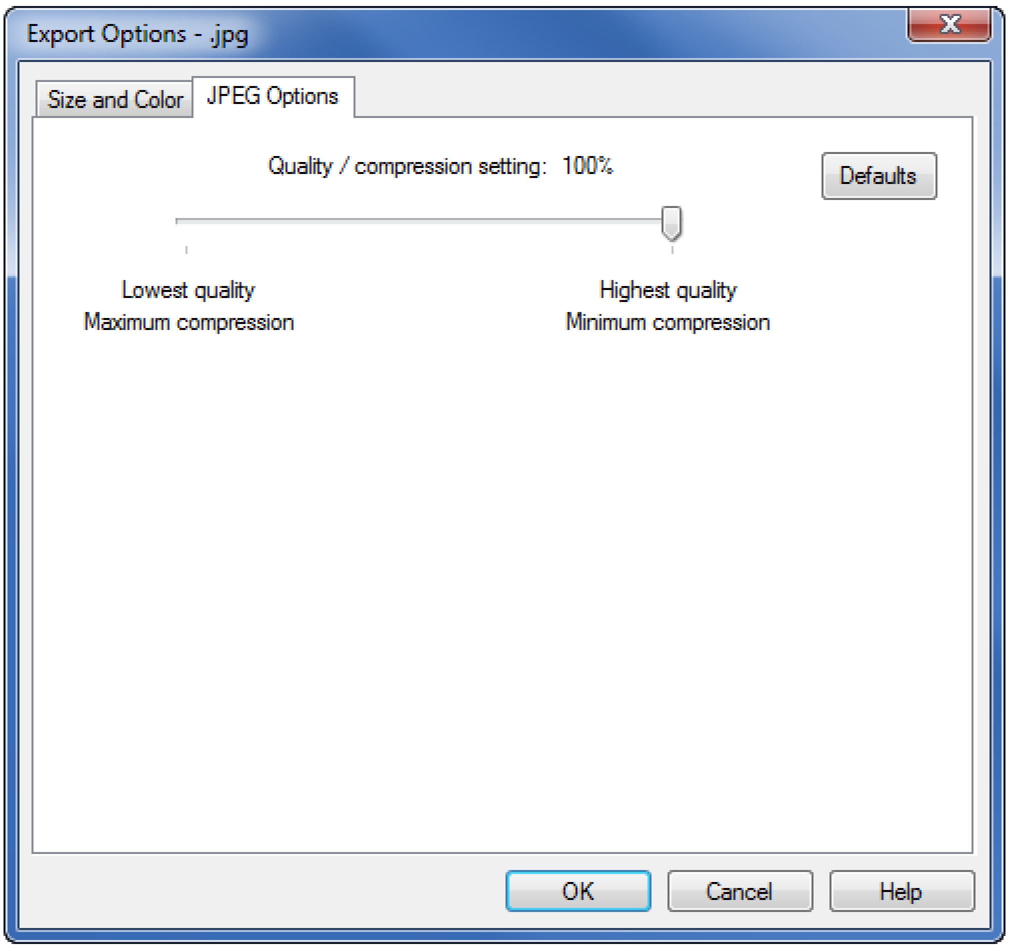
Check *Render marker symbols* to cause markers to be exported as areas and lines.

Defaults

The *Defaults* button sets all controls to default conditions.

Export Options Dialog - JPEG Options Page

The **JPEG Options** page is located in the **Export Options** dialog.



Specify the Quality/Compression Setting on the ***JPEG Options*** *page of the* ***Export Options*** *dialog.*

Quality and Compression Settings

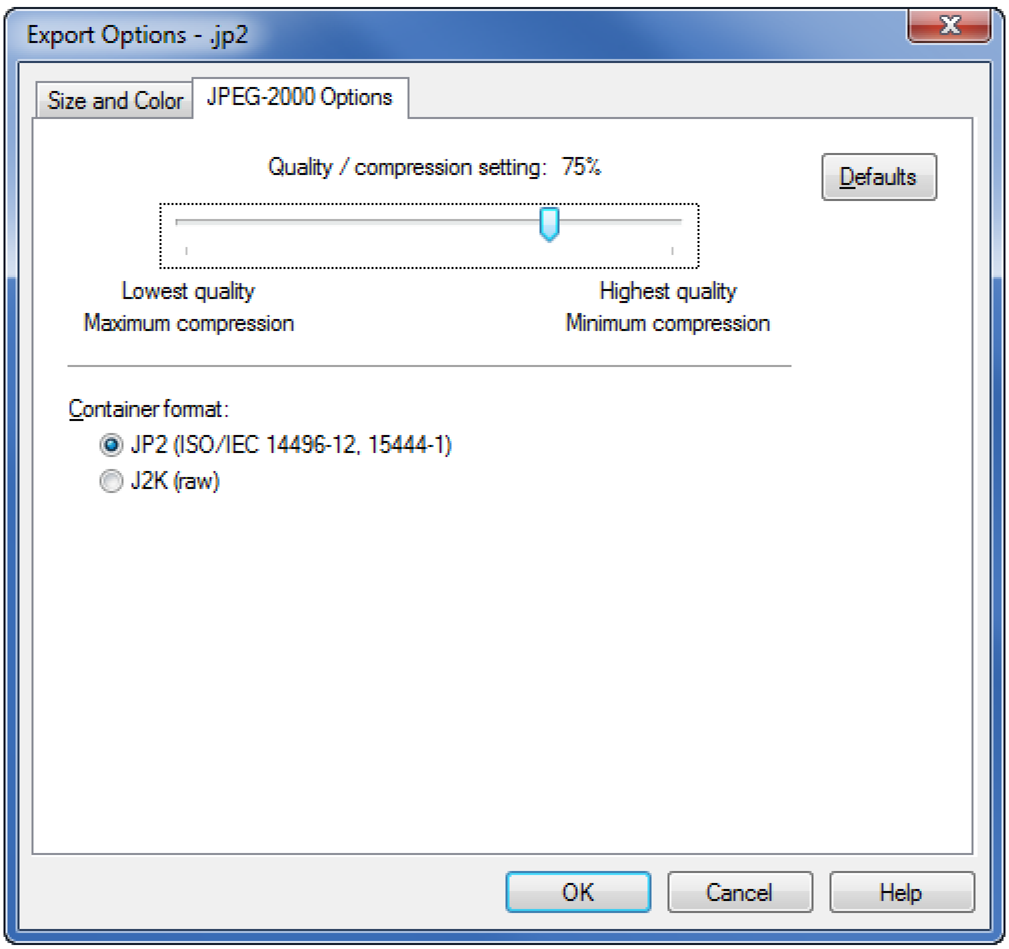
Adjust the slider for the desired compromise between image compression and image quality. Move the slider to the left for *Lowest quality/Maximum compression.* Move the slider to the right for *Highest quality/Minimal compression.*

Defaults

The *Defaults* button sets all controls to their default values.

Export Options Dialog - JPEG-2000 Options Page

The **JPEG-2000 Options** page is located in the **Export Options** dialog.



*Specify the Quality/Compression Setting on the**JPEG Options** page of the**Export Options**dialog.*

Quality and Compression Settings

Adjust the slider for the desired compromise between image compression and image quality. Move the slider to the left for *Lowest quality/Maximum compression.* Move the slider to the right for *Highest quality/Minimal compression.*

Container Format

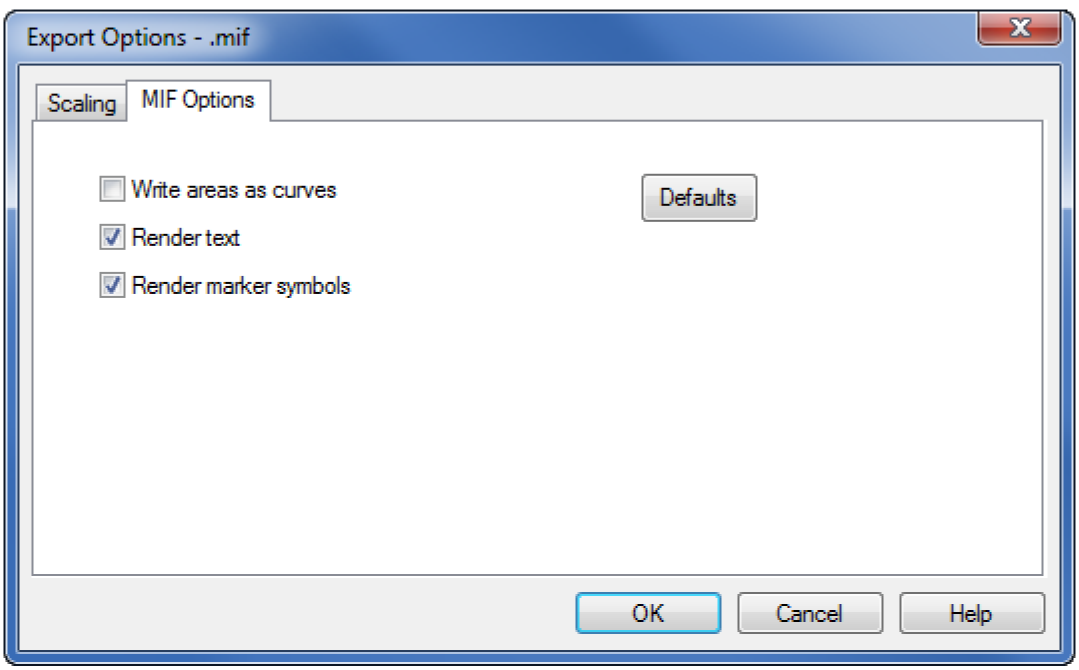
The *Container format* controls the export format. Select *JP2 (ISO/IEC 14496-12, 15444-1)* to export the image in the ISO JP2 compliant format. This format exports the image data, and organization and contents of the file. Select *J2K (raw)* to export only the image data.

Defaults

The *Defaults* button sets all controls to their default values.

MapInfo Interchange Format .MIF Export Options Dialog

The **Export Options** dialog allows you to specify how information in the file is exported.



Specify the MIF export options in the ***Export Options*** *dialog,* ***MIF Options*** *page.*

Write Areas as Curves

Check *Write areas as curves* to cause all area (polygonal) objects to be exported as curve (polyline) objects.

Render Text

Check *Render text* to cause all text objects to be exported as areas and lines. When *Render text* is unchecked, text is exported as text.

As long as there is no shear, perspective, or clipping, MIF text entities will be exported as text. This means that the MIF text entities will be sized and oriented similar to the text objects in the application document. When shear, perspective, or clipping occur, the text is exported as solid polygons. Shear occurs when the character glyphs are not perpendicular to the text baseline. Perspective occurs when the height of glyphs in the text string are not all the same, as in a 3-D view where the glyphs are smaller the farther they are from the observer. Clipping occurs when part of the text object is partially inside and partially outside the map limits.

Render Marker Symbols

Check *Render marker symbols* to cause markers to be exported as areas and lines.

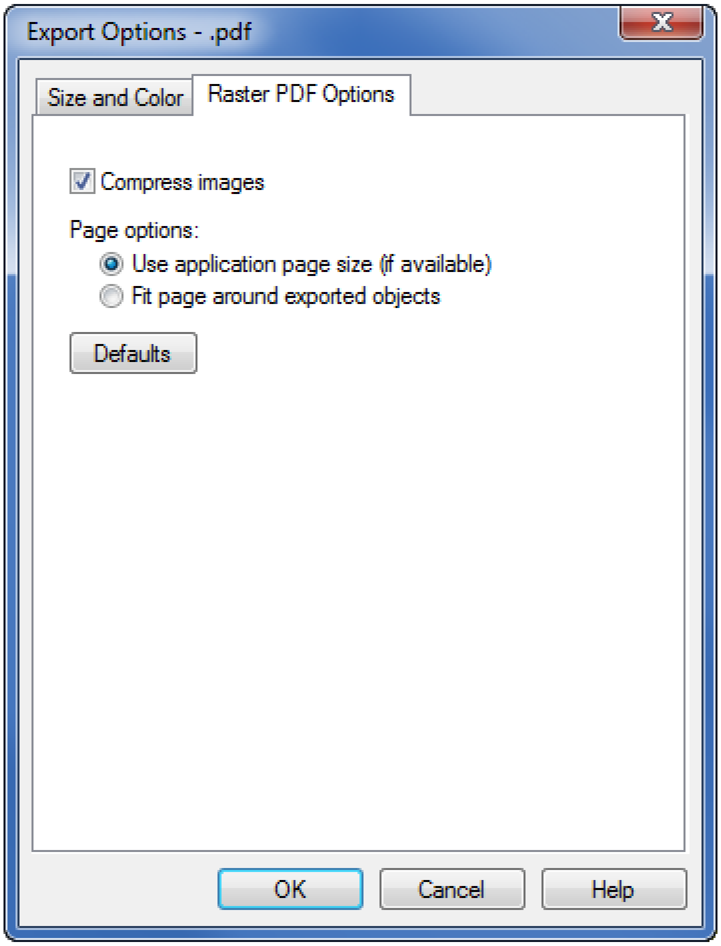
Adobe Acrobat .PDF Raster Export Options Dialog

Adobe Acrobat Portable Document Format .PDF is a file format used for document exchange. PDF is used for representing two-dimensional documents. PDF was created by Adobe Systems.

Use a raster .PDF to export the entire project as an image in .PDF format. Use the options on the Size and Color tab to set the image quality. The higher resolution image you select, the larger the .PDF file will be. All images, lines, text, maps, etc. will be exported into the single image object in the raster .PDF file. Raster objects lose quality at low resolutions or when you zoom in. The raster .PDF output will look exactly like your original project.

The Export Options Dialog (for Raster PDF)

When using the **File | Export** command to export to a PDF (Raster) file, the **Export Options** dialog allows you to specify the Size and Color options for the exported image. In addition, the **Raster PDF Options** page is available to compress the exported image and set the page size.



*Specify the Raster PDF Size and Color export options in the**Export Options**dialog,**Size and Color**page.*

Compress Images

Check the box next to *Compress images* to apply .PDF compression to the images in the .PDF file. This produces smaller raster .PDF files with no loss in quality. When this option is unchecked, .PDF files will be larger.

Page Options

The *Page options* section controls the page size in the exported .PDF file. Select the *Use application page size (if available)* to use the paper size defined in the Page Setup dialog. If *Fit page around exported objects* is selected, the page size in the .PDF file will be only as large as the objects being exported.

When the *Use application page size (if available)* is selected and objects extend beyond the page defined in the **Page Setup** dialog, the objects are clipped and not displayed in the PDF file.

Adobe Acrobat .PDF Vector Export Options Dialog

Adobe Acrobat Portable Document Format .PDF is a file format used for document exchange. PDF is used for representing two-dimensional documents. PDF was created by Adobe Systems. The vector .PDF export supports solid and partially transparent pattern, image, and gradient patterns.

Use a vector PDF to export 2D plots and 3D graphs as layers in the PDF. The layer visibility can be toggled on or off when viewing the PDF. Each 2D plot is a separate layer in the PDF. Each 3D graph is a separate layer in the PDF. Other objects, such as drawn objects, axes, legends, etc. are all contained within the top layer.

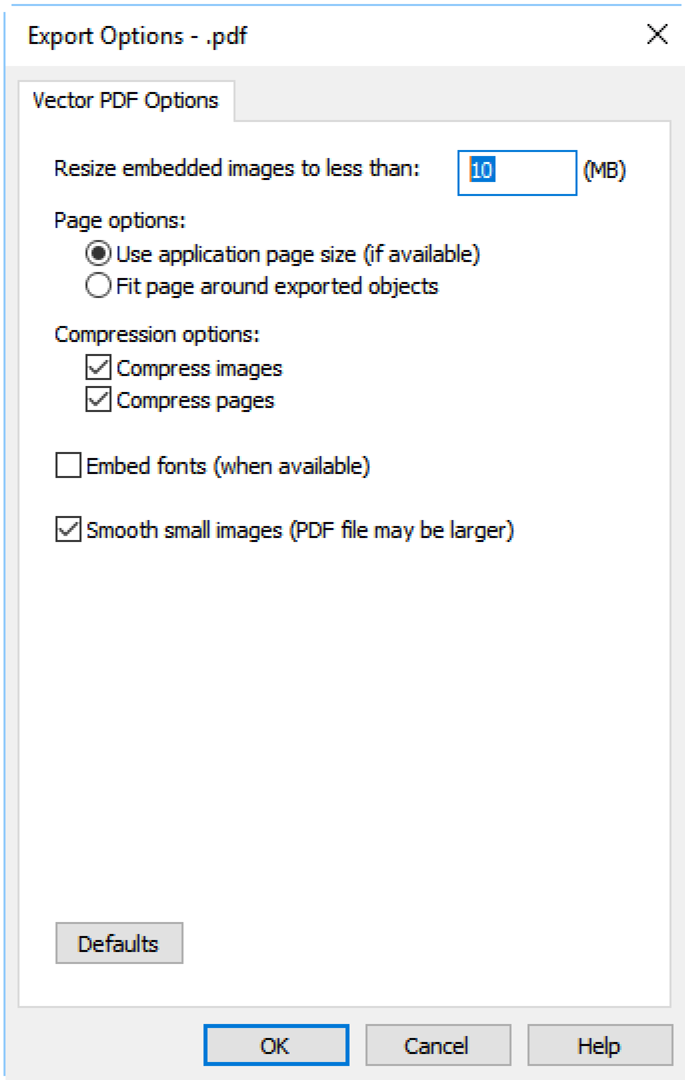
Use a vector .PDF to export the vector objects in the project (lines and text) as vector objects in the PDF. This makes the objects clear and sharp. Vector objects do not lose quality when you zoom in. It doesn't matter how much you zoom in, the line and text will always look crisp.

The images in your project will also export as images in the vector .PDF. Vector .PDF files are smaller than Raster .PDF files and are usually higher quality.

Objects that are transparent or partially transparent in **Grapher** are exported with the transparency enabled in the .PDF. There are two instances when the resulting Vector PDF appears different from the **Grapher** plot. When objects are filled with a stock fill pattern, the object's *Foreground opacity* and *Background opacity* are averaged, and the object is exported with a single average opacity. When the nodes in a colormap have differing opacity, set in the Color Gradient dialog, a single average opacity is used in the exported Vector PDF.

Vector PDF Export Options Dialog

When using the **File | Export** command to export to a vector .PDF file, the **Export Options** dialog allows you to specify the *PDF* options.



*Specify Vector PDF options in the**Export Options**dialog.*

Resize Embedded Images

The *Resize embedded images to less than* option specifies the size in megabites that an embedding image is resized to during export. Enter a value in the *MB* box. If an exported image exceeds this size, its resolution will be reduced so it doesn't exceed the designated maximum size. Increase this value to get better looking images at the expense of larger export files. The default value of *Resize embedded images to less than* option is 10MB.

As long as there is no shear, perspective, or clipping, PDF text entities will be exported as text. This means that the PDF text entities will be sized and oriented similar to the text objects in the application document. When shear, perspective, or clipping occur, the text is exported as solid polygons. Shear occurs when the character glyphs are not perpendicular to the text baseline. Perspective occurs when the height of glyphs in the text string are not all the same, as in a 3-D view where the glyphs are smaller the farther they are from the observer. Clipping occurs when part of the text object is partially inside and partially outside the plot limits.

Page Options

The *Page options* section controls the page size in the exported .PDF file. Select the *Use application page size (if available)* to use the paper size defined in the Page Setup dialog. If *Fit page around exported objects* is selected, the page size in the .PDF file will be only as large as the objects being exported.

When the *Use application page size (if available)* is selected and objects extend beyond the page defined in the **Page Setup** dialog, the objects are clipped and not displayed in the PDF file.

Compression Options

The *Compression options* section contains options that can make the PDF file size smaller.

Compress Images

Check the box next to *Compress images* to apply .PDF compression to the images in the .PDF file. This produces smaller vector .PDF files with no loss in quality. When this option is unchecked, .PDF files will be larger.

Compress Pages

Check the box next to *Compress pages* to apply .PDF compression to the entire page stream. This produces significantly smaller vector .PDF files with no loss in quality. When this option is unchecked, .PDF files will be larger.

Embed Fonts

Check the box next to *Embed fonts (when available)* to store the fonts inside the .PDF file. This produces a larger vector .PDF file, but the font in the .PDF file will exactly match the font in the **Grapher** file. When this option is unchecked, the .PDF file will be smaller, but the text may not appear the same in the .PDF file as it does in the **Grapher** file. Some fonts cannot be embedded. A different font is substituted when this is the case.

Smooth Small Images

Grapher uses bilinear interpolation to smooth the display of reduced large images and enlarged small images. Adobe Reader uses bilinear interpolation to smooth the display of a reduced large image, however it does not smooth the display when enlarging small images. Therefore some small images may appear "blocky" in a PDF output when compared to the display in the **Grapher** program.

Click the *Smooth small images (PDF file may be larger)* check box to smooth small images in the output PDF file. The *Smooth small images* options uses bilinear interpolation to upscale images less than 1MB by 2x, 4x, or 8x its original size up to, but not greater than, 1MB.

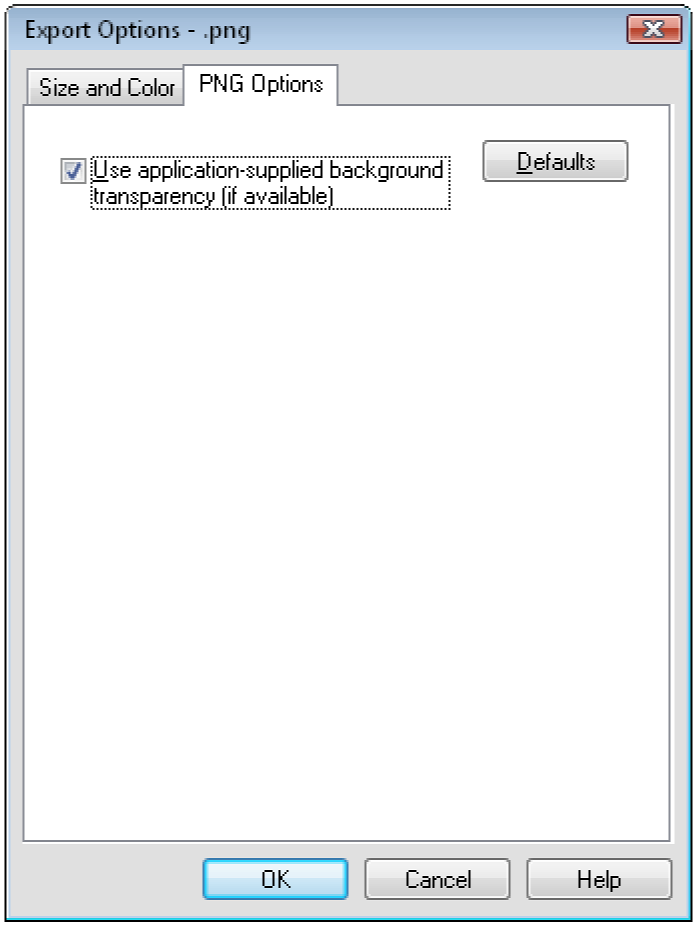
Defaults

Click the *Defaults* button to return the options to the default values.

PNG Export Options Dialog

Portable Network Graphics .PNG is an image format that employs lossless data compression. PNG files support transparency.

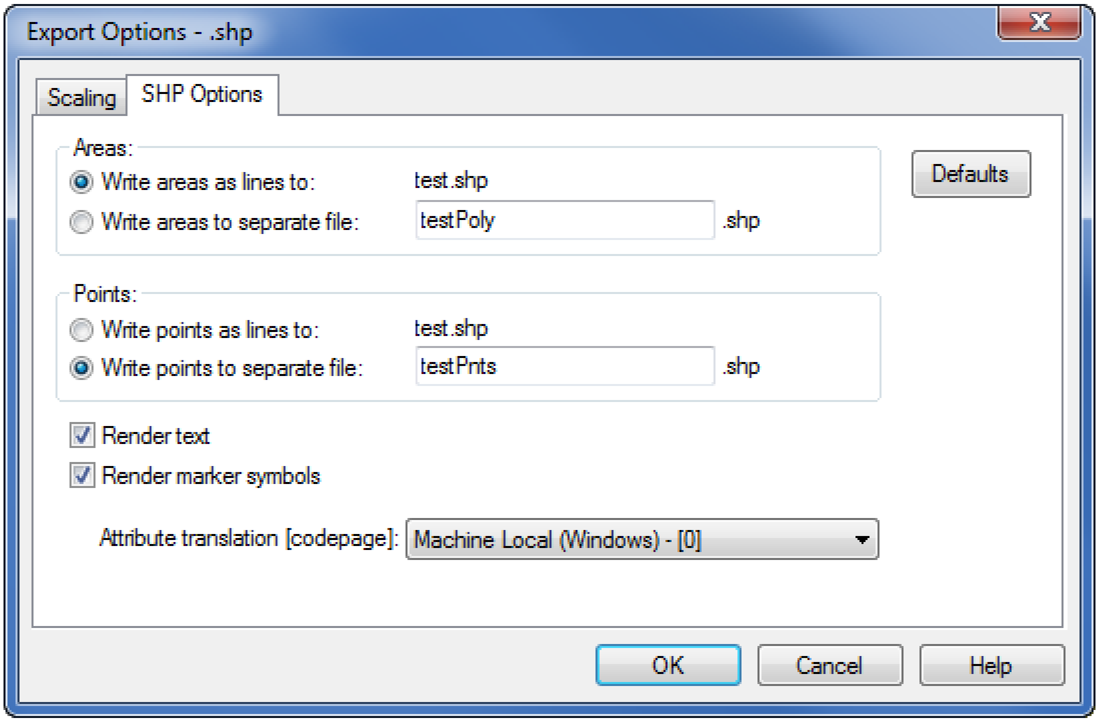
Use the **Export Options** dialog to specify the Size and Color options and the transparency options for the .PNG file. To export the .PNG file with all background areas transparent, click on the **PNG Options** tab in the **Export Options** dialog. Check the *Use application-supplied background transparency (if available)* option. The .PNG file will have transparent background areas.



Specify the transparency setting on the ***PNG Options*** *page in the* ***Export Options*** *dialog.*

Esri Shapefile .SHP Export Options Dialog

The **Export Options** dialog, **SHP Options** page allows you to specify how information in the file is exported.



Specify the SHP file export options in the ***Export Options*** *dialog.*

SHP Options Page

Note that an Esri Shapefile (.SHP) file may contain either line objects, area objects, or point objects, but not a combination of different object types.

Write Objects as Lines

All objects can be written as line objects if the *Write areas as lines* and *Write points as lines* options are both selected, or either of the afore-mentioned controls may be selected individually to write only the corresponding objects as lines. Alternatively, areas and/or points can be written to separate files by selecting the *Write areas to separate file* and/or *Write points to separate file* controls, in which case valid filename (s) must be typed into the adjacent edit control(s).

Render Text

By default, text is not output. Selecting the *Render text* control will instead cause text to be rendered as lines and/or areas as appropriate. If this box is not checked, text will not be output as the .SHP format does not support text.

Render Marker Symbols

By default, marker symbols in the drawing are output as points. Selecting the *Render marker symbols* control will instead cause marker symbols to be rendered as lines and/or areas as appropriate.

Attribute Translation

By default, the “Machine Local (Windows) - [0]” code page will be used to translate 16-bit Unicode attribute text to 8-bit ANSI text stored in the companion .DBF file. This can be changed by selecting a different code page from the drop down list. This code page will be stored in a companion .CPG file and also in the .DBF file header. If characters from multiple languages are present, consider selecting “UTF-8 - [65001]”.

Defaults

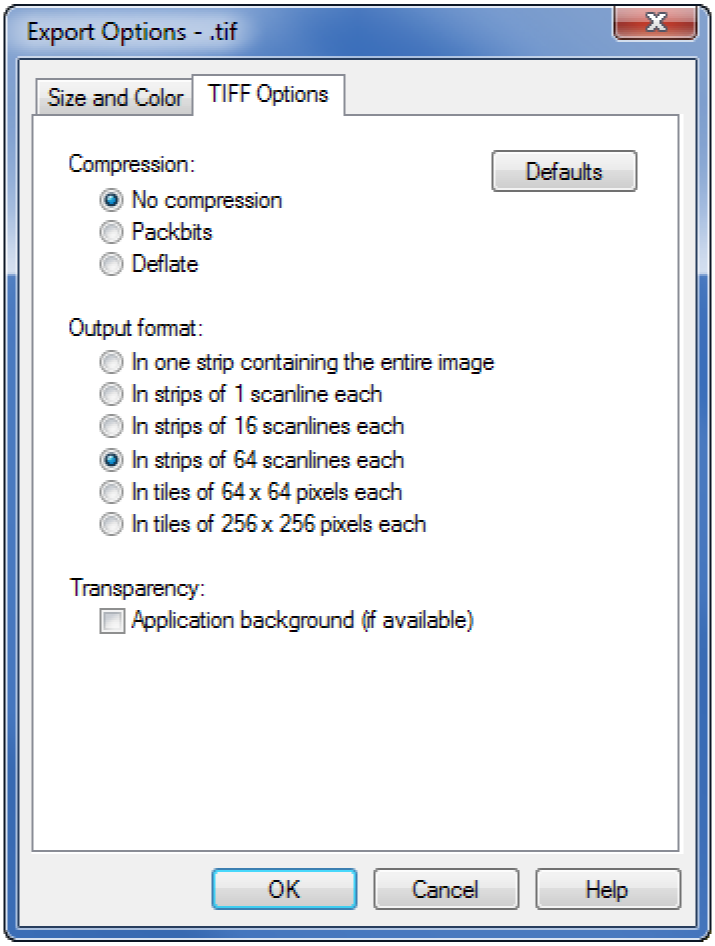
The *Defaults* button sets all options to default conditions.

Scaling Page

Scaling information can be set on the Scaling page.

Tagged Image .TIF Export Options Dialog

Grapher can import and export .TIF and .TIFF files.



Specify TIF export options in the ***Export Options*** *dialog.*

Compression

Select the type of *Compression*, if any.

- *No compression* results in a very large output file size.
- *Packbits* compression involves finding repeated data values; as a result, it is a good choice for images without large color ranges.
- *Deflate* is a dictionary encoding method that produces significant reduction in file size for most images without losing any image information.

Output Format

Choose from a variety of *strip* and *tile* output formats. The option *In one strip containing the entire image* is the least efficient option but has the highest degree of compatibly with other software.

Transparency

Use the **Export Options** dialog to specify the Size and Color options and the transparency options for the .TIF file. To export the .TIF file with all background areas transparent, click on the **TIFF Options** tab in the **Export Options** dialog. Check the *Application background (if available)* option. The .TIF file will have transparent background areas. In order for the TIF to be transparent, the *Color depth* must be set to 4-bit, 8-bit, or 32-bit on the **Size and Color** tab.

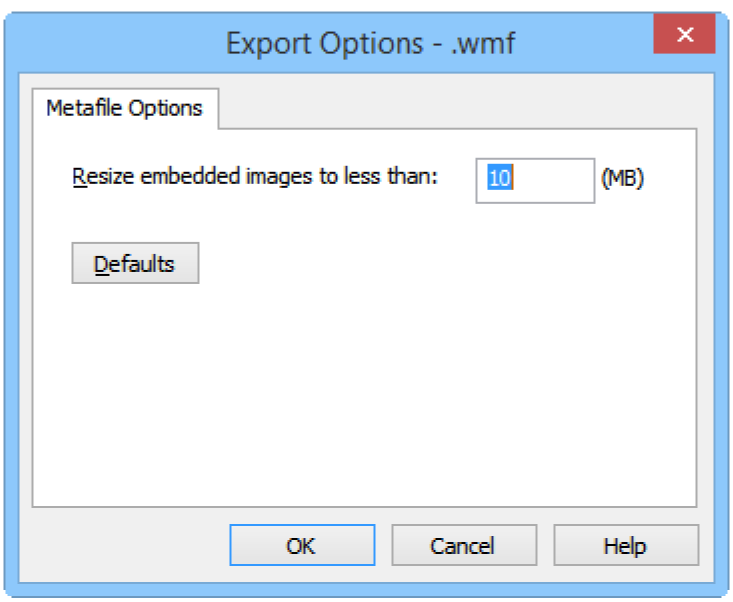
Transparent TIFF images in 4-bit and 8-bit modes use TIFF tag number 42113 (a.k.a. GDAL_NODATA) which is not yet widely supported by other applications. In applications that don't support this tag, the images appear with an opaque background (no transparency). If the application shows an opaque background where a transparent background should appear, re-export the file with 32-bit color depth. Most programs support transparent TIF files with 32-bit colors.

Size and Color Page

See Size and Color

Windows Metafile .WMF Export Options Dialog

The **Export Options** dialog allows you to specify options which determine how information in the file is exported. A Windows Metafile .WMF is a collection of objects combined together to produce an image.



Specify the WMF file export options in the ***Export Options*** *dialog.*

Resize Embedded Images

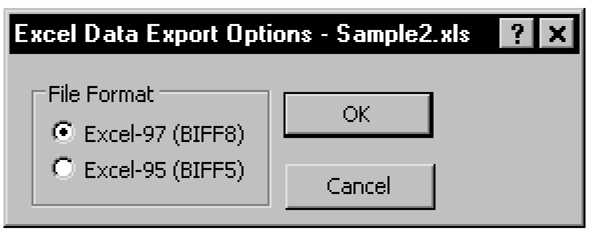
The *Resize embedded images to less than* option specifies the maximum size (in megabytes) an embedded image is allowed to be. If an exported image exceeds this size, its resolution will be reduced so it doesn't exceed the designated maximum size. Increase this value to get better looking images at the expense of larger export files.

Defaults

The *Defaults* button sets all options to default conditions.

Excel .XLS Export Options Dialog

Grapher can export .XLS files. The **Excel Data Export Options** dialog allows you to specify if the Excel file will be written in *Excel 97* or *Excel 95* format.



Select the File Format to use when exporting in the ***Excel Data Export Options*** *dialog.*

File Format

Files can be saved in either *Excel 97 (BIFF 8)* or *Excel 95 (BIFF 5)* formats.

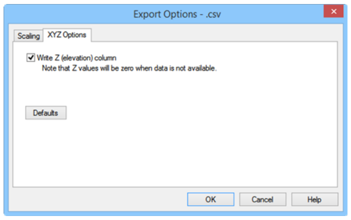
Use Caution when Saving Excel Files!

Use the File | Save To Multi-Sheet Excel File command to save multiple worksheets in a single Excel document. Note that this command only saves Excel files in the XLSX format.

A file can be saved in an Excel format from **Grapher** worksheet, ***but only one worksheet can be saved*** when using the File | Save or File | Save As command. If a multi-worksheet Excel file is opened and saved as an .XLS or .XLSX file from the **Grapher** worksheet, be aware that only the single worksheet is saved in the document. If the existing file is over-written, all the unused worksheets are destroyed. In this case, a warning message is issued. The message reads: *Saving this worksheet will destroy all but one of the sheets in the existing *.xls, *.xlsx file. To overwrite the file, click OK. To choose a different file name, click Cancel.*

XYZ Points File Export Options Dialog

Grapher can export plot documents as CSV or DAT XYZ points files. The **XYZ Options** page of the **Export Options** dialog contains the XYZ points export specific options.



*Specify export options for the DAT or CSV XYZ points file in the **XYZ Options** dialog.*

Z Column

By default the third column in the exported file contains the Z coordinate information for the points. In **Grapher** the Z column values are always 0. When the *Write Z (elevation) column* check box is not checked, the DAT or CSV file only includes X and Y coordinates and attribute values. The *Write Z (elevation) column* can be unchecked to remove the column of zeros from the output file. Click the check box to check or uncheck the *Write Z (elevation) column* option.

Defaults

Click the *Defaults* button to restore the default XYZ export options, where *Write Z (elevation) column* is checked.

Export Automation Options

ASCII .DAT, .TXT Data File Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various import options. A typical example would be:

```
" Delimiter=comma; TextQualifier=singlequote "
```

This would set the delimiter character to a comma and the text qualifier character to the single-quote mark (').

Option	Action	Default	Description
Delimiter	tab = tab comma = comma semicolon = semi-colon space = space other = enter the delimiter character	comma	Character that separates data cell values. Only one delimiter character should be specified on export. For example, if you want to export a data file using a percent signs to delimit data, add a "Delimiter=%" to the export options string.
Tex-tQualifier	double-quote = double-quote (") single-quote = single-quote (') none = none other = enter the text qual-ifier	double-quote	Specifies the character that surrounds cells con-taining text. Only one text qualifier character should be specified on export. For example, if you want to export a data file using a single quote mark as the text qualifier, add “Tex-tQualifier=singlequote” to the export options string.
FileFormat	BIFF8 = Excel-97 BIFF5 = Excel-95	BIFF8	Determines the file format when saving an XLS file.

Remarks

When specifying a delimiter and text-qualifier a semicolon is placed between the option pair, for example:

```
"Delimiter=semicolon,; TextQualifier=singlequote "
```

Golden Software Blanking [.BLN] Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

"Defaults=1,ScalingSource=0"

This would set all export options to their default values, then indicate the scaling source information should not be taken from the application, but from previously saved values.

Option	**Action**	**Default**	**Description**
BreakApartCompoundAreas	0 = No 1 = Yes	0	Compound areas (multi-ring polygons) will be split apart into multiple non-compound areas (simple polygons) during export.
WriteZ	0 = No 1 = Yes	0	Z values (elevation) will be included in the .BLN file. When Z values are not available for an object, 0 will be written in the Z column.
BlankMode	0 = Outside 1 = Inside 2 = Use BLN_Flag attribute	1	When set to 0, sets the blanking flag to 0 to blank outside areas. When set to 1, sets the blanking flag to 1 to blank inside areas. When set to 2, the BLN_Flag attribute determines the blanking flag for each object.

ScalingSource	0 = pre-viously saved 1 = applic-ation-sup-plied	1	Use previously saved or applic-ation-supplied scaling source
SaveScalingInfo	0 = No 1 = Yes	0	Save scaling parameters for later use.
PageLLX	N.N		Set application page rectangle lower left X value.
PageLLY	N.N		Set application page rectangle lower left Y value.
PageURX	N.N		Set application page rectangle upper right X value.
PageURY	N.N		Set application page rectangle upper right Y value.
FileLLX	N.N		Set scaling rect-angle lower left X value.
FileLLY	N.N		Set scaling rect-angle lower left Y value.
FileURX	N.N		Set scaling rect-angle upper right X value.
FileURY	N.N		Set scaling rect-angle upper right Y value.

Remarks

Boolean values within options strings are not equivalent to Booleans in **Scripter** BASIC. Use “1” instead of “True” and “0” instead of “False”.

Atlas Boundary .BNA Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

"Defaults=1,ScalingSourceApp=0"

This would set all export options to their default values, then indicate the scaling source information should not be taken from the application, but from previously saved values.

Option	Action	Default
`Defaults=1`	Set all options to their default values	No
`ForgetOptions=1`	Don't remember options for later use	No
`ScalingSourceApp=1`	Use application-supplied scaling parameters	Yes
`ScalingSourceApp=0`	Use saved scaling para-meters	No
`SaveScalingInfo=1`	Save scaling parameters for later use	No
`PageLLX=N.N`	Set application page rect-angle lower left X value	N/A
`PageLLY=N.N`	Set application page rect-angle lower left Y value	N/A
`PageURX=N.N`	Set application page rect-angle upper right X value	N/A
`PageURY=N.N`	Set application page rect-angle upper right Y value	N/A
`FileLLX=N.N`	Set scaling rectangle lower left X value	N/A
`FileLLY =N.N`	Set scaling rectangle lower left Y value	N/A
`FileURX =N.N`	Set scaling rectangle upper right X value	N/A
`FileURY =N.N`	Set scaling rectangle upper right Y value	N/A
`BreakApartCompoundAreas`	Break apart compound areas on export	0
`WriteZ`	1 to write Z values in the	0

	.BLN file. In **Grapher** 0 will be written in the Z column.	
BlankMode	0 to set the blanking flag to 0 (blank outside). 1 to set the blanking flag to 1 (blank inside). 2 to use BLN-Flag attribute. In **Grapher** using BlankMode=2 defaults to the blank inside (1) option.	1

AutoCAD DXF Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

```
"Defaults=1,FormatASCII=0,AllColorsSame=1"
```

This would set all export options to their default values, then indicate the DXF file will be written in binary format and that all colors will be the mapped to the default AutoCAD color.

Option	Action	Default	Description
FileCompatibility	13 = AutoCAD Release 13 (or earlier) 14 = AutoCAD Release 14 (or later) 18 = AutoCAD 2004 21 = AutoCAD 2007 (or later)	14	Specifies which version of the DXF format is to be used for export.
FormatASCII	0 = Binary	1	File format of expor-

	1 = Text (ASCII)		ted DXF file. The ASCII file format is larger than the DXF binary format, but is compatible with a wider variety of software programs.
MaxBitmapSizeInMB	N	10	For AutoCAD 2004 format, this option specifies the largest size allowed for an individual bitmap in the DXF file, in Megabytes. Any exported bitmap larger than this size, will have its resolution reduced so it does not exceed the maximum size.
AllColorsSame	0 = No 1 = Yes	0	Convert all colors to the default color.
AllStylesSame	0 = No 1 = Yes	0	Convert all line styles to the default line style.
AllWidthsSame	0 = No 1 = Yes	0	Convert all line widths to the default line width.
AllTextToAreas	0 = No 1 = Yes	0	Convert all text entities in the exported document to solid areas
FillSolidAreas	0 = No 1 = Yes	0	Fill solid area interiors.
UseSpatialInfo	0 = No 1 = Yes	0	Use ONLY spatial information. Only the basic geometry (lines, areas, text) will be written to the DXF file, and all line styles, colors, fills, and other attributes will be discarded.
ColorMapping	0 = Linear	0	Choose the indexed

	1 = Weighted LUV		color mapping as either weighted LUV export color mapping, or linear export color mapping.
RenderMarkers	0 = No 1 = Yes	1	Render marker symbols as lines and polygons. When set to 0 marker symbols are exported to the DXF file as points.
ScalingSource	0 = previously saved 1 = application-supplied	1	Use previously saved or application-supplied scaling source.
SaveScalingInfo	0 = No 1 = Yes	0	Save scaling parameters for later use.
PageLLX	N.N		Set application page rectangle lower left X value.
PageLLY	N.N		Set application page rectangle lower left Y value.
PageURX	N.N		Set application page rectangle upper right X value.
PageURY	N.N		Set application page rectangle upper right Y value.
FileLLX	N.N		Set scaling rectangle lower left X value.
FileLLY	N.N		Set scaling rectangle lower left Y value.
FileURX	N.N		Set scaling rectangle upper right X value.
FileURY	N.N		Set scaling rect-

			angle upper right Y value.

Windows Enhanced Metafile .EMF Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

```
"Defaults=1,AllTextToPolygons=0"
```

This would set all export options to their default values, then indicate that all text is not to be exported as polygons (i.e., it is to remain as text).

Option	Action	Default	Description
MaxBitmapSizeInMB	N	10	This option specifies the largest size allowed for an individual bitmap in the EMF file, in Megabytes. Any exported bitmap larger than this size will be downscaled to this size during export.

Encapsulated PostScript .EPS Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

```
"Defaults=1,ScalingSourceApp=0"
```

This would set all export options to their default values, then indicate the scaling source information should not be taken from the application, but from previously saved values.

Option	Action	Default	Description

Width	N		Sets the width of the exported image in pixels. Either a Width or an HDPI option may be specified, but not both.
Height	N		Sets the height of the exported image in pixels. Either a Height or a VDPI option may be specified, but not both.
HDPI	N	96	Sets the number of horizontal pixels in the exported image that corresponds to a distance one horizontal inch on the Grapher plot. Either a Width or an HDPI option may be specified, but not both. The default HDPI is the resolution of the display device driver on your computer (this is 96 dots per

			inch on many Windows display devices, but number can very from device to device).
VDPI	N	96	Sets the number of vertical pixels in the exported image that corresponds to a distance of one vertical inch on the Grapher plot. Either a Height or a VDPI option may be specified, but not both. The default VDPI is the resolution of the display device driver on your computer (this is 96 dots per inch on many Windows display devices, but number can very from device to device).
KeepAspect	0 = No 1 = Yes	1	If set to 1, KeepAspect ajusts the aspect ratio (the width versus

height) of the exported image to match the aspect ratio of the Grapher plot that is being exported. If an option is given to set the Width or HDPI of an image, KeepAspect automatically assigns the appropriate Height or VDPI to maintain the same aspect ratio as the Grapher plot. Likewise, if an option is given to set the Height or VDPI of an image, KeepAspect automatically assigns the appropriate Width or HDPI to maintain the same aspect ratio of the Grapher plot. Note that the KeepAspect option is ignored if both the Width and Height

			he aspect ratio of the exported image is determined solely by the Width and Height or HDPI and VDPI options. The size is not adjusted to match the aspect ratio of the Grapher plot.
IgnoreRefInfo	0 = Save spatial references 1 = Ignore spatial references	1	Ignore any spatial reference information.
SaveRefInfoAsInternal	0 = No 1 = Yes	0	Save spatial references to internal format (if possible).
SaveRefInfoAsBlueMarbleRSF	0 = No 1 = Yes	0	Save spatial references as Blue Marble .RSF file.
SaveRefInfoAsESRIWorld	0 = No 1 = Yes	0	Save spatial references as Esri World file.
SaveRefInfoAsGSIREF	0 = No 1 = Yes	0	Save spatial references as Golden Software Reference (version 1) file.
SaveRefInfoAsGSIREF2	0 = No	0	Save spatial

	1 = Yes		references as Golden Software Reference (version 2) file.
PreviewType	0 = None 1 = EPSI 2 = TIFF	2	Specifies whether an embedded preview image is to be included in the EPS file, and in what format the embedded preview image is to be stored.
PreviewColor	0 = Grayscale 1 = Color	1	Choose whether the preview image is exported in Color or Grayscale.
PreviewSize	0 = < 64 KB 1 = < 512 KB 2 = 25% of PostScript Image 3 = 50% of PostScript Image 4 = 100% of PostScript Image	1	Choose what size of EPS preview image is encoded in the export file.

Image (Bitmap) Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

```
"Defaults=1,Width=640,Height=480,ColorDepth=4"
```

This would set all export options to their default values, then set the bitmap width to 640 pixels, the bitmap height to 480 pixels and the color depth to 4 (i.e., 256 colors).

Note: A script writer is allowed to change the size of a bitmap, even if it has associated georeference parameters. New (but possibly not minimal RMS) georeference parameters will be automatically calculated and saved. Avoid using the "Width=", "Height=", "HDPI=" or "VDPI=" automation options if you do not want associated georeference parameters recalculated.

Option	Action	Default	Description
Width	N		Sets the width of the exported image in pixels. Either a Width or an HDPI option may be specified, but not both.
Height	N		Sets the height of the exported image in pixels. Either a Height or a VDPI option may be specified, but not both
HDPI	N	96	Sets the number of horizontal pixels in the exported image that corresponds to a distance one horizontal inch on the Grapher plot. Either a Width or an HDPI option may be specified,

			but not both. The default HDPI is the resolution of the display device driver on your computer (this is 96 dots per inch on many Windows display devices, but number can very from device to device).
VDPI	N	96	Sets the number of vertical pixels in the exported image that corresponds to a distance of one vertical inch on the Grapher plot. Either a Height or a VDPI option may be specified, but not both. The default VDPI is the resolution of the display device driver on your computer (this is 96 dots per inch on many Windows display devices, but number can very from device to device)
KeepAspect	0 = No 1 = Yes	1	If set to 1, KeepAspect ajusts the aspect ratio (the width versus height) of the exported image to match the aspect ratio of the Grapher plot that is being

			exported. If an option is given to set the Width or HDPI of an image, KeepAspect automatically assigns the appropriate Height or VDPI to maintain the same aspect ratio as the Grapher plot. Likewise, if an option is given to set the Height or VDPI of an image, KeepAspect automatically assigns the appropriate Width or HDPI to maintain the same aspect ratio of the Grapher plot. Note that the KeepAspect option is ignored if both the Width and Height options or the HDPI and VDPI options are specified. If set to 0, the aspect ratio of the exported image is determined solely by the Width and Height or HDPI and VDPI options. The size is not adjusted to match the aspect ratio of the Grapher plot.
KeepPixelSize	0 = No 1 = Yes	0	Locks the pixel dimension width and height. Changes to the

			VDPI and HDPI will affect the document size, but not the pixel size, when this is set to 1. Changes to the VDPI and HDPI will affect the pixel dimensions, but not the document size, when this is set to 0. Note that the KeepPixelSize option is ignored if the either the Width or Height option is specified.
ColorDepth	-32 = 32-bit grayscale -16 = 16-bit grayscale -8 = 8-bit grayscale -4 = 4-bit grayscale -1 = Monochrome 1 = 1-bit color indexed 4 = 4-bit color indexed 8 = 8-bit color indexed 24 = 24-bit true color 32 = 32-bit true color with	24 for most formats 8 if the format doesn't support 24-bit true color	Specifies the color depth (or pixel format) of the exported image. The greater the color depth, the more faithfully the image will represent the colors assigned to objects in your document. Note that not all color depths are supported by all export filters. In cases where the requested format is not supported by a particular export filter, the export procedure will automatically select an alternate format that is compatible with the export filter.

	alpha		
ColorReductionMethod	1 = Ordered Dither 2 = Diffuse Dither 3 = Popularity 4 = MedianCut555 5 = MedianCut888	5	In cases where an indexed ColorDepth has been selected for the exported image, the ColorReductionMethod option selects which algorithm is used to reduce the 16 million possible colors in the Grapher plot down to the actual number of colors available in the image's color table.
Quality	N	100	For JPG and JPG2 export only. Set compression quality 0 - 100. A value of 100 is highest quality.
Compress	0 = No compression 1 = Packbits 2 = Deflate	0	For TIF export only. Set the compression type of an exported TIF file. For PDF (raster) export, compresses images in the PDF to reduce file size.
CompressImages	0 = False 1 = True	1	For PDF Raster export only. Compresses images in the PDF to reduce file size.
FitPage	0 = Use application page size 1 = Fit	0	For PDF Raster export only. Sets the size of the PDF to the applic-

	page around exported objects		ation page size, if true. Otherwise PDF page size is set to the size of the exported objects.
Format	0 = Monolithic (one strip) 1 = One row per strip 2 = 16 rows per strip 3 = 64 rows per strip 4 = 64x64-pixel tiles 5 = 256x256-pixel tiles	3	For TIF export only. Choose from a variety of strip and tile output formats when exporting TIF files. The option In one strip containing the entire image is the least efficient option but has the highest degree of compatibly with other software.
SaveRefInfoAsInternal	0 = No 1 = Yes	0	Save spatial references to internal format (if possible)
SaveRefInfoAsBlueMarbleRSF	0 = No 1 = Yes	0	Save spatial references as Blue Marble .RSF file
SaveRefInfoAsESRIWorld	0 = No 1 = Yes	0	Save spatial references as Esri World file
SaveRefInfoAsGSIREF	0 = No 1 = Yes	0	Save spatial references as Golden Software Reference (version 1) file
SaveRefInfoAsGSIREF2	0 = No 1 = Yes	0	Save spatial references as Golden Software Reference (version 2) file
BackgroundColor	16777216 = no trans-	16777216	Color value for transparency for

	parency 16777217 = background transparency 16777215 = white transparency 0 = black transparency less than 16777216 = custom color transparency		GIF export only. If the value is less than 16777216, the color is composed of red, green, and blue and is set to a custom color. The color value is calculated by: Red + Green*256 + Blue*65536 where Red, Green, and Blue are values between 0 and 255.
UseTransparency	0 = No 1 = Yes	0	Use application background transparency for PNG export only. If set to 1, background is transparent.
FormatJ2K	0 = JP2 container 1 = J2K container	0	Sets the Container Format for JPG-2000 export only.

Golden Software Boundary .GSB Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

```
"Defaults=1,AreasToCurves=1"
```

This would first set all export options to their default values, then specify that all areas be output as lines.

Option	Action	Default	Description
BreakApartCompoundAreas	0 = No	0	Compound

	1 = Yes		areas (multi-ring polygons) will be split apart into multiple non-compound areas (simple polygons) during export.
GsbVersion	3 = GSB version 3 4 = GSB version 4 5 = GSB version 5	5	Specify the version of the exported GSB file.
ScalingSource	0 = previously saved 1 = application-supplied	1	Use previously saved or application-supplied scaling source.
SaveScalingInfo	0 = No 1 = Yes	0	Save scaling parameters for later use.
PageLLX	N.N		Set application page rectangle lower left X value.
PageLLY	N.N		Set application page rectangle lower left Y value.
PageURX	N.N		Set application page rectangle upper right X value.
PageURY	N.N		Set application page rectangle upper right Y

		value.
FileLLX	N.N	Set scaling rectangle lower left X value.
FileLLY	N.N	Set scaling rectangle lower left Y value.
FileURX	N.N	Set scaling rectangle upper right X value.
FileURY	N.N	Set scaling rectangle upper right Y value.

Golden Software Interchange [.GSI] Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

```
"Defaults=1,AreasToLines=1"
```

This would first set all export options to their default values, then specify that all areas be output as lines.

Option	Action	Default	Description
AreasToLines	0 = No 1 = Yes	0	Output polygons to exported GSI file as polylines.
RenderMarkers	0 = No 1 = Yes	0	If set to 0, marker symbols will be output to the export file as marker objects. If set to 1, marker symbols will be output to the export file as lines and areas to retain the shape and look of the symbol.

RenderText	0 = No 1 = Yes	0	If set to 0, text will be output to the export file as text objects. If set to 1, text will be output to the export file as lines and areas to retain the shape and look of the font face.
ScalingSource	0 = previously saved 1 = application-supplied	1	Use previously saved or application-supplied scaling source.
SaveScalingInfo	0 = No 1 = Yes	0	Save scaling parameters for later use.
PageLLX	N.N		Set application page rectangle lower left X value.
PageLLY	N.N		Set application page rectangle lower left Y value.
PageURX	N.N		Set application page rectangle upper right X value.
PageURY	N.N		Set application page rectangle upper right Y value.
FileLLX	N.N		Set scaling rectangle lower left X value.
FileLLY	N.N		Set scaling rectangle lower left Y value.
FileURX	N.N		Set scaling rectangle upper right X value.
FileURY	N.N		Set scaling rectangle upper right Y value.

MapInfo Interchange Format [.MIF] Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

```
"Defaults=1,AreasToLines=1"
```

This would first set all export options to their default values, then specify that all areas be output as lines.

Option	Action	Default	Description
AreasToCurves	0 = No 1 = Yes	0	Output polygons to exported MIF file as poly-lines.
RenderMarkers	0 = No 1 = Yes	0	If set to 0, marker symbols will be output to the export file as marker objects. If set to 1, marker symbols will be output to the export file as polylines and polygons to retain the shape and look of the symbol.
RenderText	0 = No 1 = Yes	0	If set to 0, text will be output to the export file as text objects. If set to 1, text will be output to the export file as poly-lines and polygons to retain the shape and look of the font face.
ScalingSource	0 = previously saved 1 = application-supplied	1	Use previously saved or application-supplied scaling source.
SaveScalingInfo	0 = No 1 = Yes	0	Save scaling parameters for later use.
PageLLX	N.N		Set application page rectangle lower left X value.
PageLLY	N.N		Set application page rectangle lower left Y value.
PageURX	N.N		Set application page rectangle upper right X value.

PageURY	N.N	Set application page rectangle upper right Y value.
FileLLX	N.N	Set scaling rectangle lower left X value.
FileLLY	N.N	Set scaling rectangle lower left Y value.
FileURX	N.N	Set scaling rectangle upper right X value.
FileURY	N.N	Set scaling rectangle upper right Y value.

Adobe Acrobat Portable Document Format .PDF (Vector) Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options.

Option	Action	Default	Description
MaxBitmapSizeInMB	N	10	This option specifies the largest size allowed for an individual image in the PDF file, in Megabytes. Any exported bitmap larger than this size, will have its resolution reduced so it does not exceed the maximum size.
CompressImages	0 = False 1 = True	1	Compresses images in the PDF to reduce file size.
CompressPages	0 = False 1 = True	1	Compress page streams in the PDF to reduce file size.
EmbedFonts	0 = False 1 = True	0	Embed fonts in the PDF file. When set to 1, the file size increases, but the

			text in the PDF looks identical to the **Grapher** file.
FitPage	0 = Use application page size 1 = Fit page around exported objects	0	Sets the size of the PDF to the application page size, if true. Otherwise, PDF page size is set to the size of the exported objects.
SmoothSmallImages	0 = False 1 = True	1	Upscales the image resolution, and therefore file size, for small images less than 1MB. This smooths the display of small images in the output PDF.

SEG SP1 Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

"Defaults=1, ScalingSource=0"

This example would set the options to the default values, then use the previously saved scaling source

ScalingSource	0 = previously saved 1 = application-supplied	1	Use previously saved or application-supplied scaling source.
SaveScalingInfo	0 = No 1 = Yes	0	Save scaling parameters for later use.
PageLLX	N.N		Set application page rectangle lower left X value.
PageLLY	N.N		Set application page rectangle lower left Y value.

PageURX	N.N		Set application page rect-angle upper right X value.
PageURY	N.N		Set application page rect-angle upper right Y value.
FileLLX	N.N		Set scaling rectangle lower left X value.
FileLLY	N.N		Set scaling rectangle lower left Y value.
FileURX	N.N		Set scaling rectangle upper right X value.
FileURY	N.N		Set scaling rectangle upper right Y value.

Esri Shapefile [.SHP] Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

```
"Defaults=1,AreasToFile=1"
```

This would first set all export options to their default values, then specify that all areas be output to a separate file.

Option	Action	Default	Description
AreasToFile	0 = No, write areas as lines 1 = Yes, write areas as separate file	0	Write areas to separate file.
PointsToFile	0 = No, write points as lines 1 = Yes, write areas as separate file	0	Write points to separate file.
RenderMarkers	0 = No, export as points	0	Any marker objects will be converted to areas for export; otherwise

	1 = Yes, render markers		markers are exported as points.
RenderText	0 = No, discard text 1 = Yes, render text	0	Any text objects will be converted to areas for export; otherwise text is discarded.
ScalingSource	0 = previously saved 1 = application-supplied	1	Use previously saved or application-supplied scaling source.
SaveScalingInfo	0 = No 1 = Yes	0	Save scaling parameters for later use.
PageLLX	N.N		Set application page rectangle lower left X value.
PageLLY	N.N		Set application page rectangle lower left Y value.
PageURX	N.N		Set application page rectangle upper right X value.
PageURY	N.N		Set application page rectangle upper right Y value.
FileLLX	N.N		Set scaling rectangle lower left X value.
FileLLY	N.N		Set scaling rectangle lower left Y value.
FileURX	N.N		Set scaling rectangle upper right X value.
FileURY	N.N		Set scaling rectangle upper right Y value.

Note that if *Shp_AreasToFile* is set to 1, the filename used for the areas file will be the same as the specified export filename with the suffix *Poly* added to the basename. For example, if the specified export filename is *ColoradoHydrography.SHP*, the areas file will be *ColoradoHydrographyPoly.SHP*.

Likewise, if *Shp_PointsToFile* is set to 1, the filename used for the points file will be the same as the specified export filename with the suffix *Pnts* added to the basename.

SVG Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

"Defaults=1, ScalingSource=0"

This example would set the options to the default values, then use the previously saved scaling source

ScalingSource	0 = previously saved 1 = application-supplied	1	Use previously saved or application-supplied scaling source.
SaveScalingInfo	0 = No 1 = Yes	0	Save scaling parameters for later use.
PageLLX	N.N		Set application page rectangle lower left X value.
PageLLY	N.N		Set application page rectangle lower left Y value.
PageURX	N.N		Set application page rectangle upper right X value.
PageURY	N.N		Set application page rectangle upper right Y value.
FileLLX	N.N		Set scaling rectangle lower left X value.
FileLLY	N.N		Set scaling rectangle lower left Y value.
FileURX	N.N		Set scaling rectangle upper right X value.
FileURY	N.N		Set scaling rectangle upper right Y value.

Windows Metafile .WMF and .EMF Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options.

Option	Action	Default	Description
MaxBitmapSizeInMB	N	10	This option specifies the largest size allowed for an individual bitmap in the EMF file, in Megabytes. Any exported bitmap larger than this size, will have its resolution reduced so it does not exceed the maximum size.

Microsoft Excel Export Automation Options

Since the **Excel Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options. A typical example would be:

```
"FileFormat=biff5"
```

This would set the file format to BIFF5, i.e., Excel 95.

Option	Action	Default
FileFormat	Determines the file format. Valid values: biff8 (Excel 97) biff5 (Excel 95)	biff8

XYZ Data File Export Automation Options

Since the **Export Options** dialog is not displayed when the program is driven from an automation script, an options string can be specified in the script. The string consists of comma-separated parameters, which specify the behavior of the various export options.

Option	Action	Default	Description
WriteZ	0 = No 1 = Yes	1	Set to 1 to write the Z values in the third column of the data file. If a Z value is not available, 0 will be written in the third column. Set to 0 to export only the X and Y coordinates.
ScalingSource	0 = previously saved 1 = application-supplied	1	Use previously saved or application-supplied scaling source.
SaveScalingInfo	0 = No 1 = Yes	0	Save scaling parameters for later use.
PageLLX	N.N		Set application page rectangle lower left X value.
PageLLY	N.N		Set application page rectangle lower left Y value.
PageURX	N.N		Set application page rectangle upper right X value.
PageURY	N.N		Set application page rectangle upper right Y value.
FileLLX	N.N		Set scaling rectangle lower left X value.
FileLLY	N.N		Set scaling rectangle lower left Y value.
FileURX	N.N		Set scaling rectangle upper right X value.
FileURY	N.N		Set scaling rectangle upper right Y value.

Index

+

+ in grid 38

0

0 to 100 scale 710

1

1 point polar vector plot 336
1 point vector plot 410
1:1 847

2

2 point polar vector plot 336
2 point vector plot 410
2D bar chart 285, 291
2D box-whisker plot 440
2D bubble plot 225
2D class scatter plot 234, 323
2D cumulative plot 692
2D fit plot 537
2D floating bar 307
2D function 218
2D graphs 205, 211, 217, 225, 234, 285, 307, 319, 339, 342, 349, 357, 371, 405, 410, 417, 423, 439, 452
2D hi-low-close 405
2D histogram 423
2D line/scatter 205
2D line/scatter plot properties 206, 259
2D pie chart 452
2D polar 319
2D polar bar chart 342
2D polar class scatter plot 323
2D polar function 339
2D radar plot 364
2D rose diagram 349
2D step plot 211
2D stiff plot 417
2D summation plot 674, 691

2D ternary diagram 371
2D vector plot 410
2D wind chart 357

3

3D axis color 710
3D back 659
3D bubble plot 531
3d class scatter plot 278
3D donut plot 473
3d doughnut plot 473
3D fill 639, 793
3D fit plot 246, 537
3D floating bar 309
3D function 263
3D graphs 246, 251, 257, 263, 269, 278, 288, 290, 309-310, 424, 453, 473
3D grid lines 726
3D histogram 424
3D line plot 246
3D pie chart 453, 531
3D properties 206, 226, 247, 259, 270, 288, 390, 659, 710
3D rotation 927
3D settings 481, 659
3D step plot 251
3D trackball 874
3d vector plot 412
3D XYY bar chart 288, 291, 294
3D XYY doughnut plot 473
3D XYY floating bar 309, 311
3D XYY floating bar chart 309, 311
3D XYY function 219, 263, 265
3D XYY function plot 219, 263, 265
3D XYY histogram 424-425
3D XYY pie chart 453
3D XYY ribbon/wall 246, 251
3D XYY step plot 246, 251
3D XYZ bar chart 290
3D XYZ bubble plot 228, 269, 272, 392, 1005

3D XYZ class scatter plot 278
3D XYZ floating bar chart 310
3D XYZ line/scatter plot 258, 278

9

95% Confidence Interval for the Mean 169
99% Confidence Interval for the Mean 169

A

A=G(T) 340
A1 column 336
A2 column 336
abbreviate character strings 600, 840
above 586, 593, 745
above baseline area 704
absolute value 125, 158, 994
across then down 184
active cell 37, 112-113
active cell edit box 37, 112, 114
active cell location 37, 112-113
active cell location box 113
active formats 603, 843
activeX automation members 953
actual size 852
add axis 659, 669
add bin 354, 363, 435
add criteria range 581
add date 762, 844
add date format 762, 844
add date/time 762, 844
add date/time format 762, 844
add duplicate axis 675
add format 762, 844
add legend 659, 673, 678
add magnifier 676, 696
add methods 985
add or edit format 762, 844
add plot 191, 206, 213, 226, 247, 252, 259, 270, 320, 390, 659, 670-671
add text 806

add time 762, 844
add time format 762, 844
add title 659
add to existing graph 191
add to graph 65, 189, 669, 671, 675-676, 696
add watch 949
adding a graph title 81
adding a legend 89
adding new data 108
adding semi-transparent fill - tutorial 82
adjacent bars 297, 343
adjust to 181
Adobe 1062
after 711
after division 710
after scale 710
after spacing 710
Align 865, 867
align objects 867
align vertical 867
alignment 136-137, 742
alternate above-below 586
alternate equation name 554
alternate left-right 586
always split 943
AM 763, 845
AN? 1019
and 155, 992
angle 457, 467, 478, 584, 593, 662, 714, 720, 729, 742
angle 1 column 339
angle 2 column 338
angle axes 719
angle axis 707, 720
angle column 322, 347
angle limit 723
angle magnitude polar 336
angle offset 587
angle width 346
angle width value 343

angled 717
angled labels 587
angled marks 729
annotate 774
antialias lines 923
antialias text 923
aperture size 913
Application property 985
ARAM 336
ARAR 336
arc size 360
arc size value 358
area 704
area baseline value 705
arguments 958
arrange 864, 869
arrange align 867
arrange icons 848, 854
arrange menu 864
arrange tab 864
arrange tab commands 864
arranging objects 27
array variables 963
arrays 965
ASCII data 146
ASCII files 1021
ASCII grid file 1050
assign coordinates 699
assigning colors to the color table 651
asymmetrical error bars 563
at major labels only 726
at major ticks 727
at minor labels only 727
at minor ticks 727
atlas BNA file description 1029
auto backup on 913, 921
auto redraw 848, 853
auto track worksheets 108-109, 928
AutoCAD DXF export 903

AutoCAD DXF file description 1041
AutoCAD DXF import 886
AutoGraph hierarchy 982
automatic 600, 714, 720, 840, 931
automatic axis positioning 717
automatic bins 352, 361, 431
automatic tick labels 735
automatically check for updates 913
automation 941, 944-946, 953-957, 959, 962-965, 967-969, 974, 977-978, 984-987, 1209
automation help 976
automation references 977
available fits 537
average bar width 569
average deviation 169
average indicator 563
average value only 565
average X 555
average Y 555
away from reference 563
axes 95
axes limits dialog 769
axes on edges 699
axis 83, 95, 659, 669, 672, 707, 710, 717, 720, 725, 770
axis color 726
axis defaults 932
axis labels 102, 710, 723, 729, 744, 757
axis length 713, 720
axis limits 103, 546, 710, 757, 764, 769
axis maximum 710, 733
axis minimum 714, 733
axis page 710
axis position 710, 718, 720
axis properties 28, 83, 95, 709-710, 719-720, 725, 735
axis properties - stiff plot x axis 710
axis scale 711
axis title 83, 716, 723
axis type dialog 709
axis types 707

B

back 869
back up 913
back up files 920
back wall 659
back wall properties 659
background 136, 640, 794
background color 640, 794
background properties 659
backup 914
backup every 913
backup file path 913, 921
backup files 921
backwall 659
backward 869
bar 35
bar base 301
bar cap 567
bar chart 285, 288, 290-291, 294, 305, 311, 342, 347, 703
bar chart groups 305, 347
bar chart multiple variable data files 291
bar chart properties 294
bar charts 286
bar charts use same rows 929
bar overlap 298
bar step 567
bar width 298, 315, 347, 406, 428, 569
bars line properties 563
base 298, 428
base fill 639, 793
base line properties 627, 828
base properties 514
base value 301
baseline value 704
BASIC 955, 974
basic objects 932
before 710
before division 710

before spacing 710
below 582, 593, 742
below baseline area 704
bessel functions 157, 993
between fill 664
between ticks 746
bidirectional 354
bin range 355, 363, 437
bin size 351, 359, 429
bin width 425
bins 359, 429
bins type 353, 361, 431
bitmap 1007
bitmap export 903
bitmap import 886
bitmap pattern 640, 794
bitmap properties 847
black and white 184
blanking file format 1023
BLN 1007, 1023
BLN export 903
BLN files 102
BLN import 886
block select 791-792, 864
BMP 1007
BMP export 903
BMP import 886
BNA 1007
BNA export 903
BNA file example 1029
BNA files 102
BNA import 886
bold text 71
Boolean 963
Boolean expressions 160, 997
both character and numeric 600, 840
both directions 563
both XY 717
bottom 183, 867

boundary 1007
bounding box 790
box-whisker labels 448
box-whisker plot 440, 443, 729, 735
box-whisker plot axis 707
box-whisker plot data 441
box-whisker plot properties 443
box-whisker plot X axes 725
box-whisker plot X axis 725
box axis 725
box fill properties 464, 659
box line properties 464, 659
box plot 439, 442
box plot labels 448
break apart 872, 874
break at spaces 743
break axis 710
break composite 872
break from 710
break from date/time 710
break position 710
break to 710
break to date/time 710
breakpoint 950
bubble color 1005
bubble plot 225-226, 269-270, 390
bubble plot properties 226, 270, 390
bubble plots 226, 270, 390
bubble radius 230, 274, 394
bubble symbol 229, 273, 393
bubble X rotation 233, 277, 397
bubble Y rotation 233, 277, 397
bubbles 389
button 40
buttons 40-41
byte 962

C

calculate area 704

calculation 150
calibrate 699
cancel printing 912
CancelButton 972
candlestick 409
candlestick plot 405
cap 567
cap length 445
cascade 848, 853
cascade windows 853
categories 286
category bar charts 286
cell 113
cell alignment 137
cell background 139
cell coordinates 987
cell edit box 114
cell format 137
cell format alignment 137
cell justification 137
cell numeric format 140
cell properties 136-138, 140
cells 102, 119-121
center 136, 586, 593
center of doughnut plot 455, 475
center on page 183
center position for doughnut plot 455, 475
centroid 229, 273, 393
centroid symbol 229, 273, 393
change axis 206, 213, 219, 226, 247, 252, 259, 265, 270, 294, 311, 390, 406, 425, 447
change data 109, 206, 213, 226, 247, 252, 259, 270, 294, 311, 320, 343, 351, 358, 375, 390, 406, 425, 442, 455, 475
change plot to 703
change source 898
change symbols on ternary plot 377
change view 921
change worksheet 206, 213, 226, 247, 252, 259, 270, 294, 311, 320, 343, 351, 358, 375, 390, 406, 425, 442, 455, 475

changes in worksheet 108
changing the line/scatter plot properties - tutorial 78
changing the number of symbols - tutorial 90
changing the symbol size - tutorial 90
changing the tick mark spacing - tutorial 95
changing the window layout 33
changing the X axis date/time tick label format - tutorial 96
changing the y axis limits - tutorial 96
changing tick mark labels 86
changing tick mark spacing - tutorial 85
chart of import/export file type features 1007
check 916
check display 849
check for announcements 913, 920
check for update 68
check for updates 913, 919
check managers 849
CheckBox 972
choose axes 671
circle 780
class module 966-967
class module example 969
class plot legend defaults 932
class plot symbol size 690
class plots 377
class properties 244, 333, 387
class scatter plot 234-235, 278-279, 323-324, 379
class symbol 244, 333, 387, 690
classes files [.GCL] 240, 329, 383
classes on ternary plot 377
clear 130
clear all breaks 950
clear graph rotation 876
clear rotate 876
clear rotation 876
clear selected cells 130
click and rotate 874
clipboard 125
clipping 103, 546, 569, 577, 581, 758, 764

clipping properties 570
clockwise 721
close 985
close column 408
closing scripts 944
CLP 1007
CLP export 903
CLP import 886
CLR 615, 1005
code for date/time 762, 844
code module 966-967
coefficient of determination 542, 555
coefficient of kurtosis 170
coefficient of skewness 171
coefficient of variation 172
coefficients 557
collate 911
collection objects 984
collections 984
color 614, 652, 800
color column 643, 798
color depth 1157
color fill 226, 270, 390
color for symbols 631, 832
color format 1157
color gradient 625, 642, 797
color modulation 517
color palette 652, 800
color scale 503, 533
color spectrum 615
color spectrum file format 1005
color table 645, 650, 800
colors 652, 800, 942
column 124, 582, 590
column criteria 578, 581
column labels 123
column letters 37, 112
column step 444
column width 123, 141

columns 145
columns dialog 579
columns in legend 90
columns qq plot 469
columns to rows 177
combine 871, 873-874
ComboBox 972
comma 602, 842
comma delimit 1022
command 40
command line 946
commands 40
comments 956
compare two data sets 468
comparison operators 160, 997
compatibility 974
composite 873
composite object 871-872
compress PDF files 12
compute transform 148
confidence intervals 554, 558, 560
connection page 627, 828
connector properties 676, 696
container format 1166
continuity 569
continuous 574
continuous data 569
continuous stream of points 776
contour data map 485-486
contour function 499
contour function map 499
contour function map plot properties 500
contour grid map 495-496
contour lines on grid 38
contour map 485, 489, 495, 503, 506, 509
contours 38, 847
convert a 3D graph 703
convert a matrix to a grid 494
convert an array to a grid 494

converting older files 1016
coordinate arrays 965
coordinates 699, 701, 703, 1011
copies 911
copy 858
copy existing format 861
copy format 861
copy properties 861
cos 157, 993
Count property 984
counterclockwise 722
cover areas by 639, 793
cover mode 639, 793
covert a 2D graph 703
create from file 893
create function from X, Y, Z 499
create graph 191
create new 893
create new graph 191
create template 814
create text 806
create/edit template 814
creating a graph 76
creating a graph title 465, 660
creating a line/scatter plot tutorial 94
creating a new data file 72
creating a template graph 65, 189, 201
creating data 72, 76
creating dialog boxes 970
creating graphs 65, 189
creating graphs from the worksheet 67, 190
creating graphs in the plot window 66, 189
creating graphs using templates 67, 190
creating graphs with the graph wizard 66, 189
creating multiple graphs on a page 668, 771
creating text 774
criteria 569, 576, 581
criteria value 581

critical value of K-S statistic at 90% 95% and 99% significance level 173
CSV 1021
CSV files 102
cumulative plot 430, 692
currency 136, 140, 962
current date 185
current time 185
cursor coordinates 35
custom 570
custom angle 865, 874
custom base 301, 428
custom bin 356, 437
custom bins 352, 354, 361, 431, 435
custom colors 653, 655
custom date/time format 762, 844
custom date/time formatting 762, 844
custom dialog box 970, 973
custom fit equation 545
custom fit equations 545
custom grid line spacing 728
custom negative 566
custom rotate 874
custom settings 45, 935
custom tick range 729
customize 45, 935
customize keyboard commands 45, 935
customize Quick Access Toolbar 45, 935
customize ribbon 45, 935
customize your display 49
cut 858
cutoff 641, 796
cutoff value 517, 639, 793

D

DAT 1021
DAT Files 102
data 108-109, 116, 441, 569, 577, 905, 1085
data column 352, 427, 456, 477

data columns 208, 214, 228, 249, 254, 260, 272, 296, 313, 392, 408, 444
data criteria 574, 576
data export options 1144
data file 102
data file formats 102
data file list 108
data files 101, 108, 1021, 1078, 1085
data import options 1089
data in the plot 108
data limits 546
data link 880
data link properties 880
data maximum 301, 428, 733
data minimum 301, 428, 733
data overview 101
data point labels 462, 582, 588, 590, 594
data points count 206, 213, 226, 247, 252, 259, 270, 294, 311, 320, 343, 351, 358, 375, 390, 406, 425
data sort 146
data statistics 163
data value 462, 594
data values 35
database 880, 1032
date 102, 185, 571, 714, 757, 764, 806, 963
date format 102, 104, 136, 600, 757, 762, 840, 844
date formatting 102, 757, 762, 844
date label format 762, 844
date labels 102, 735, 757
date time format 104
date/time 102, 601, 757, 759, 762, 841, 844
date/time format 141, 762, 844
date/time formatting 102, 757, 762, 844
date/time label format 762, 844
date/time labels 759
date/time tick labels 735
day 764, 846
dbase 1032
DBF 1032

DDF 1008
DDF import 886
debug.print 948
debugging scripts 947
decimal digits 136, 141
decimal separator 600, 840, 915
declaration statements 956
default 932
default action 49
default axis 932
default basic objects 932
default class plot legend 934
default class symbol size 690
default digitize format 931
default fill properties 931
default font properties 931
default graph 934
default legend 934
default line properties 931
default manager location 849
default objects 932
default open action 49
default options 913
default path 914
default plot 932
default settings 913, 932
default symbol properties 931
default wind chart legend 934
default window location 849
defaults 932
defaults: digitize format 931
defaults: fill 931
defaults: font 931
defaults: line 931
defaults: symbols 931
define custom bin 356, 437
define fit equation 545
defining object properties and methods 968
degree 550

degrees 157, 721, 993
delete 27, 130, 659, 863-864, 985
delete bin 354, 364, 435
delete selected 864
delete selected cells 130
deleting fill 664
deleting objects 27
demo 9
demo and the tutorial 71
dense 743
depth 481
derived objects 985
descending 716
deselect all 793, 864
deselect selected objects 793
destination column 149
detach legend 680
dialog 972
dialog boxes 970
diameter of doughnut plot 455, 475
different positive and negative error bar 563
digital line graph 1038
digitize 701-702
digitize fixed 702
digitize format 931
digitize format defaults 931
digits after decimal point 931
direction 354, 360, 563, 641, 721, 796
direction column 338, 358, 417
disable labels 719
disable tick marks 719
discontinuous 569
discontinuous data 569
display 847, 849
display A values 582
display all managers 847
display appearance 921
display as percentages 358
display as relative frequency 358

display centroid symbols 226, 270, 390
display close labels 588
display contour in grid window 38
display contours 38
display grid 925
display grid nodes in grid window 38
display high labels 589
display horizontally 294, 311
display info area 924
display labels 462, 583, 589-590, 594
display look 921
display low labels 588
display managers 847, 849
display margins 922
display nodes 38
display nodes in grid window 38
display object manager 847
display open labels 589
display options 921
display page outline 922
display PI info area 921
display property manager 847
display R values 582
display rulers 925
display script manager 847
display status bar 847
display style 921
display tabs 924
display value on click 928
display values as relative frequency 425
display vertically 294, 311
display wind legend 358
display worksheet 109
display worksheet manager 847
display X values 582
display Y values 584
displaying hidden columns or rows 145
displaying plot labels - tutorial 79
dividing line 123

divisions 732
DLG 1008, 1038
DLG import 886
do loop 957
docking managers 34
docking mechanism 34
document control next 924
document size exported 1155
don't move object 866
don't resize object 867
donut plot 472-473
dos 1016
double 962
double quotes and text 956
doughnut center 455, 475
doughnut hole size 455, 475
doughnut plot 472-473
doughnut plot legend 672, 678
doughnut plot page 455, 475
doughnut plot properties 455, 475
down fill style 410
down then across 184
drag labels 604, 662
drag size 863
drag with outline only 922
draw menu commands 773
draw method 232, 276, 396
draw text 806
drawing a circle 781
drawing a polygon 775
drawing a polyline 776
drawing a rectangle 778
drawing a rounded rectangle 779
drawing a spline polygon 783
drawing a spline polyline 782
drawing a symbol 778
drawing an ellipse 781
drawing text 774
drop lines 209, 231, 262, 275, 395

DropListBox 972
duplicate axis 675
dx 412
DXF 1008, 1041
DXF export 903
DXF import 886
dy 412
dz 412

E

E00 import 886
edit 897
edit a custom fit 545
edit class 244, 333, 387
edit classes 240, 329, 383
edit classes ternary plot 377
edit composite 873
edit custom date/time format 762, 844
edit date format 762, 844
edit date/time format 762, 844
edit equation 546
edit format 762, 844
edit object in group 873
edit properties 28
edit template 814
edit text 807
edit time format 762, 844
editing a template graph 201
editing object IDs 26
editing pie slices 460
editing scripts 943
editing worksheet cells 35, 110
ellipse 780
embed object 895
EMF 1008
EMF export 903
EMF import 886
enable Z 483
end if 957

end select 957
end style 630, 831
enter group 864, 873
enter null value 577, 580
enter weight 546
entering data 35, 110, 113-114
entries 682
environment options 913
EPS 1008
EPS export 903
EPS import 886
equation 219, 265, 340, 547
equation formats 817
equation graph 217
equation name 554
equations 149, 991
error 351
error bars 563
error strings and special numeric values 118
error style 351
errors 947
example 969, 973
examples 162, 999
Excel 112
Excel export automation options 1209
Excel files 1078, 1085
Excel merge automation options 1143
exclude data 569, 577, 580-581
exit group 864, 874
explosion factor 455, 475
exponential 136, 601, 841, 931
exponential fit 538
exponential format 140
exponential functions 157, 994
export 903, 1007
export data 905
export footer 913
export header 916
export header/footer 916

export JPG2 1165
export opacity 903
export options 1155, 1209
export PDF with page size 12
export PDF with transparency 12
export plot data 905
export transparency 903
exported document size 1155
extension into slice 464, 596

F

factor 445
file export 903
file format 1005
file formats 102, 129, 1012
file import 886
file list 23
file name 185
file options 913
file path 914
file types 53
files are no longer supported 1016
files that Grapher supports 53
fill 639, 646, 664, 793
fill between plots 667
fill color 640, 795
fill defaults 931
fill direction 639, 793
fill orientation 642, 797
fill palette 646
fill patterns 646
fill plots 639, 793
filter data 569, 576
find 131
find and replace 132
find next 131
first column 444
first line label 463, 595
first quartile 440

first row 208, 214, 228, 249, 254, 260, 272, 296, 321, 345, 351, 358, 375, 392, 408, 427, 448, 456, 477, 585, 589, 591
first row value 206, 213, 226, 247, 252, 259, 270, 294, 311, 320, 343, 351, 358, 375, 390, 406, 425, 442, 462, 582, 588, 590, 594
first tick 733
first tick date/time 729
first value 219, 265, 340
fit curve 424
fit curves 537
fit data 905
fit equation 545, 555
fit plot 537, 546
fit properties 546
fit smoothness 546
fit statistics 553-554
fit to 182
fit to page 912
fit to window 848-849
fits 206, 213, 247, 252, 259, 320, 425, 537, 541, 550
fits qq plot 469
fitted data limits 546
fixed 136, 601, 841, 931
fixed format 140
fixed scale 710
fixed width 302, 315
flip 177
flip columns and rows 177
flip rows and columns 177
flip tick marks and labels 719
flip z direction 482
floating bar 307, 309, 311
floating bar chart labels 582
floating bar properties 311
floating managers 33
flow control 957
flow control statements 956
font properties default 931
footer 182, 184, 908
for each 958

for next 957
foreground color 640, 794
format 102, 136, 600, 757, 762, 840, 844
format cell property 136
format cells 136
format column width 141
format copy 861
format date/time 762, 844
format from selected 862
format painter 861-862
format paste 862
formulas 149, 156, 992
forward 869
frame 672, 678, 684
free rotate 865, 874
frequency 222, 267, 340, 361, 430, 553, 742
from edge 183
from worksheet 86, 463, 595, 737, 766
front 869
full screen 848, 852
function 217, 219, 263, 265, 339-340
function contour 499
function data 905
function interval 219, 265, 340
function plot 219, 263, 265, 340
function plot properties 219, 265
functions 148, 155, 959, 991
functions dialog 991

G

Gaussian fit 537
GCL 244, 333, 387
GCT 652
general 136, 601, 841, 913
general format 140
general options 913
GetFilePath 970
GIF 1008
GIF export 903

GIF export options 1160
GIF import 886
global variables 965
Golden Software blanking file description 1023
Golden Software boundary file description 1056
GPJ 53
gradient detail 233, 277, 397
gradient fill 642, 796
gradient type 642, 796
grads 723
graph 65, 189
graph coordinates 701-702
graph defaults 932
graph labels 462, 594
graph magnifier 676, 696
graph properties 28, 659
graph rows 177
graph title 81, 465, 660
graph types 56, 205, 211, 217, 225, 234, 246, 251, 257, 263, 269, 278, 285, 288, 290, 307, 309-310, 319, 323, 339, 342, 349, 357, 371, 405, 410, 417, 423-424, 439, 452-453, 473, 485, 495, 513, 521, 526
graph wizard 66, 189, 191
graph wizard from start up 49
grapher 1 1016
Grapher demo 9
Grapher help 12
Grapher object model 977
Grapher objects 978
Grapher project files 53
Grapher user interface 19
graphs 668, 771
GRF 53
grid dialog 38
grid document 37
grid info 38
grid information 38, 500
grid lines 707, 720, 726
grid nodes 38

grid window 37
gridding properties 489, 518
gridlines 184
group 864, 871, 873
group bars by category 286
group objects 871, 874
GroupBox 972
grouped pie charts 472
GRT 201
GSB 1009, 1056
GSB Import 886
GSI 1009, 1057
GSI export 903
GSI import 886
GST 613, 615

H

H 863, 867
handle size 927
hard disk space 10
header 182, 184
height 864
height of object 863
help 12
hi-low-close 405
hi-low-close plot 406
hi-low-close plot labels 588
hi-low-close plot properties 406
hidden columns 143, 145
hidden rows 144-145
hide all 848
hide all managers 849
hide columns 145
hide managers 849
hide rows 145
hiding axes 770
hiding columns 141, 145
hiding rows 143, 145
hierarchy 978-979, 982

high column 408
highlight worksheet 928
histogram 351, 354, 423-425, 435
histogram custom bin 356, 437
histogram image 433, 657
histogram information 905
histogram properties 426
hole 458, 479
hole size 458, 479
horizontal alignment 586, 864, 867
horizontal bar chart 294, 704
horizontal bar step 567
horizontal category bar chart 286
horizontal centering 182
horizontal drop lines 210, 231, 262, 275, 396
horizontal error bars 563
horizontal floating bar chart 311
horizontal histogram 425
horizontal offset 590
horizontal ruler 925
horz drop axis 210, 232, 262, 276, 396
horz drop line properties 232, 276, 396, 627, 828
hour 764, 846
how often to check for updates 913
how to customize the ribbon 40
how to edit ternary axis 768
how to link text to worksheet cell 813
how to minimize the ribbon 40

I

icon 40
icons 40
ID 25, 659, 897
if 957
if function 161, 997
image import automation 1133
immediate 942
import 886, 1007
import (worksheet) 127

import database 880
import file types 1016
import pdf 1113
import PDF automation options 1137
import pdf page 1113
import seg 1070
in 847, 850
include script comments 917
include X value 592
include Y value 594
include Z value 592
increment 219, 265, 340
increment class symbol size 690
individual contour level 513
initial open save path 913
InputBox 970
insert 130
insert cell 813
insert cells 130
insert date/time 762, 844
insert new object 893
insert object 893
insert worksheet cell 813
inset 676, 696, 788
inset zoom 788
integer 962
interface 19
international 84
internet help resources 13
interpolation factor 469
introducing Scripter 941
introduction to Grapher 9
inverse distance to a power 492
invert 793, 864
invert selection 790, 793, 864
invisible axis 770
irregular polygon plot 364
is data normally distributed 468
italic text 71

Item 984

J

jp2 1060
JP2 export 1165
jp2000 1060
jpeg 2000 1060
JPG 1009
JPG-2000 Options 1165
JPG 2000 1060
JPG export 903
JPG import 886
justification 137

K

keep axes synched 368
keep object from moving 866
keep object from resizing 867
keep objects from moving 866
keyboard customize 45, 935
keyboard shortcuts 47, 937
Kolmogorov-Smirnov goodness of fit statistic for normal distribution 173
kurtosis 170

L

label angle 744
label box-whisker 448
label box plot 448
label date format 762, 844
label date/time format 762, 844
label format 104, 451, 463, 585, 590, 592, 595-596, 600, 743, 758-759, 802, 840
label line 464, 596
label line length 462, 594
label line properties 462, 594
label offset 735
label order 592
label position 586, 593, 604, 662
label value divisor 741

label whisker 448
labels 80, 103, 123, 448, 462, 582, 588, 590, 594, 604, 662, 735, 757, 759
labels column 455, 475
labels in Y column 582
labels on side 745
labels type 584
landscape 182
last column 444
last row 206, 213, 226, 247, 252, 259, 270, 294, 320, 343, 351, 358, 375, 390, 406, 425, 462, 585, 589, 591, 594
last row value 206, 213, 226, 247, 252, 259, 270, 294, 311, 320, 343, 351, 358, 375, 390, 406, 425, 442, 462, 582, 588, 590, 594
last tick 733
last tick date/time 734
last value 219, 265, 340
layered doughnut plots 455, 475
layered pie charts 472
layout 33
layout color 921
left 136, 183, 584, 593
legend 90, 362, 659, 672, 678-681, 685, 687
legend - doughnut plot 672, 678
legend - pie chart 672, 678
legend defaults 932
legend entries 687
legend line length 681
legend number of symbols 681
legend properties 681
legend properties pie chart 681
legend symbols 681
length 710, 720, 729
length range 416
levels 500, 506, 509
levels - contour maps 506, 509
LGO 1008
LGO import 886
LGS 1008
LGS import 886

lighting properties 531
limit plot 569
limits 103, 757, 764
line 205, 776
line-fill properties 455, 475
line color 232, 276, 396, 629, 829
line color column 629, 829
line continuation 956
line count 233, 277, 397
line defaults 931
line fill 683
line length 683
line palette 633
line plot 205-206, 246, 257, 259, 703
line properties 729
line step 226, 251, 270, 390, 627, 828
line style 633
line/scatter 205, 257
line/scatter plot 76, 205, 703
line/scatter plot properties 206, 259
linear 711
linear fit 538
linear gradient fill 639, 793
linear grid 369
lines 408
lines page 627, 828
link 880
link object 895
linked text 809
linked worksheet 813
linking text objects to worksheet cells 774
linking worksheet to cells 806
linking worksheets to cells 810
links 898
list data 108
list of files 22
list worksheets 108
ListBox 972
ln 157, 711, 994

loaded 943
loading a color table 652
lock 866-867
lock movement 866
lock position 865-866
lock size 865, 867
log base 10 710
log fit 537
log program actions 917
log10 157, 994
logrithmic fit 537
long 962
loop 957
low column 408
lower level properties - confidence 627, 828

M

magnifier 676, 696-697, 788
magnifier connection 676, 696
magnifier lines 627, 828
magnifier properties 627, 677, 697, 828
magnify 788, 850
magnitude column 415
maintain aspect ratio 1157
maintain pixel dimensions 1157
major label text 735
major line properties 627, 726, 828
major tick 729
major tick grid line 726
major ticks 95
manager layout 33
manager not displayed 849
manager positions 33
managers 19, 33, 849
manual axis positioning 717
map defaults 932
margin 684-685, 774
margins 182
marker 777

math 148, 155, 991
math text examples 822, 999
mathematical functions 155, 219, 265, 340, 991
matrix of grid nodes 1050
matrix to grid 494
max chars 600, 840
max label mode 735
maximize the plot window display space 49
maximum 714
maximum absolute value 125
maximum bin value 354, 362, 435
maximum class 244, 333, 387
maximum columns 124
maximum data value 230, 274, 394
maximum date/time 714
maximum length 416
maximum radius 230, 274, 394
maximum rows 124
maximum value 710
MDB 1018
mean 174
mean square 556
median 439
medium 743
memory requirements 124
menu 40
menu commands 71
menus 40
merge 1143
merge files (worksheet) 127
mesh properties 627, 828
mesh properties - surface maps 627, 828
metafile 1083
metafile export 903
metafile import 886
metafile properties 846
methods 953, 968, 986
methods and properties 986
microsoft access MDB 1018

middle 867
MIF 1010
MIF export 903
MIF import 886
min label mode 735
minimum 714
minimum absolute value 125
minimum bin 429
minimum bin value 354, 362, 435
minimum class 244, 333, 387
minimum data value 230, 274, 394
minimum date/time 710
minimum length 416
minimum radius 230, 274, 394
minimum system requirements 10
minimum value 425, 710
minor line properties 627, 728, 828
minor tick 729
minor tick division 710
minor tick grid line 727
minutes 764, 846
missing data 569
modify existing fill 664
module properties 968
module types 966
modules 944, 968-969
monitor resolution 10
month 764, 846
most recently used list 22
mouse rotate 874
move 865
move backward 865, 870
move forward 865, 870
move labels 80, 604, 662
move plot labels 605, 663
move to back 864, 871
move to front 865, 869
moving axes 719
moving labels 80

MRU file list length 22, 913
multiple columns in the legend 90
multiple documents 924
multiple graphs 668, 771
multiple selection properties 792
multiplier 566
multivariate bar charts 291

N

name 687
named arguments 959
natural log 711
negative direction 563
negative error bar 563
new bin range 354, 363, 435
new bin range dialog 356, 437
new data 72
new features 12
new module 944
new plot 206, 226, 247, 259, 270, 294, 320, 347, 390
new scripts 944
new top-level legend 679
new view 853
new window 848, 853
new worksheet 72
next 958
no 1x's 603, 843
no maximum 355, 363, 437
no minimum 355, 363, 436
nodes 38
none 571
normal distribution 468
normal distribution fit 537
normal q-q plot 468
normal qq plot 469
normalize data 375
not 156, 992
null 580
null criteria 577

null value 577, 580
number 136
number format 140
number of bins 430
number of data points 555
number of points 219, 265, 340, 552
number of slices 455, 475
number of symbols 683
number of undo levels 913
numbers as text 178
numeric format 140, 931
numeric precision 124
numeric resolution 124

O

object 897, 962
object alignment 867
object browser 953
object dimensions 35
object hierarchy 979, 982
object ID 26, 897
object linking and embedding 895
object manager 25, 28, 33, 847
object manager gone 849
object manager tree 26
object model 977
object module 966-967
object name 35
object variables 963
object visibility 26
objects 953, 978, 985
odds ratio 563
offset 716, 721, 729, 744
offset label 582
OKButton 972
old menu 49
old toolbars 49
old view 40
OLE 893, 895, 897-898

online help 12
only character 600, 840
only numeric 603, 843
opacity 598, 628, 640, 710, 795, 804, 807, 828, 903
open 877
open - OLE 897
open column 408
open document 49
open Excel 112
open new template 49
open uses 944
open with plot 49
open with plot and worksheet 49
open with worksheet 49, 913
open with worksheet and plot 49
opening a worksheet window 112
opening dialog 49
opening object properties 25
opening the script manager 91
operators 957
option explicit 947
optional arguments 958
OptionButton 972
options 913, 931
options - backup 920
options - display 921
options - plots 927
options - rulers and grid 924
options - selection 926
options - updates 919
options menu commands 913
options page 184
or 155, 992
order 551, 865, 869
orientation 181, 299, 427
orientation of histogram 425
origin 537-538, 707, 710, 719-720
orthogonal factors 542
orthogonal polynomial factors 557

orthogonal polynomial fit 537, 546
orthogonal polynomial regression 541
orthogonal polynomial regression references 544
out 847, 851
outlier symbol 447
outliers 446
outliers as symbols 442
overlap 297, 912
overlapped pie charts 472-473
overlay contour 486
overlay properties 513
overlay surface on contour 486
overview of Grapher objects 978

P

page 181, 848, 850
page fill 922
page layout (worksheet) 180
page number 185
page order 184
page setup 181
page setup (worksheet) 180-182, 184
page units 924
paint format 862
pan 848, 852
paper size 181
paper source 182
parallel axis 727
parametric 220, 266
Parent property 985
paste 858, 890
paste existing properties 862
paste format 862
paste formatter 862
paste properties 862
paste special 125, 859, 891
pattern 640, 794
pause 948
PCT 1007

PCT export 903
PCT import 886
PDF 1062
PDF export 903
PDF import automation options 1137
pdf import options 1113
PDF vector 903
percent 140
percentage 462, 594
personalize your display 49
picture 972
picture pattern 639, 793
pie chart 452-453, 455, 475
pie chart labels 462, 594
pie chart legend 672, 678
pie chart legend format 681
pie chart legend properties 672, 678
pie chart properties 455, 475
pie chart slices 460
pie chart with hole 472
pie chart with no center 473
pie slice properties 455, 475
pie with hole 473
pixel dimensions 1155
plot 191, 659, 669, 671, 703
plot average bar 569
plot bars at average 563
plot data 108
plot defaults 932
plot document 24
plot fill 639, 793
plot from template 50
plot from wizard 49
plot interval 546
plot label 451
plot labels 103, 462, 584, 589, 591, 594, 757
plot page - contour function map 500
plot page - doughnut plot 455, 475

plot properties 28, 206, 213, 219, 226, 235, 247, 252, 259, 265, 270, 279, 294, 311, 320, 324, 340, 343, 351, 359, 375, 379, 390, 406, 413, 419, 425, 442, 486, 496, 515, 523, 527, 546
plot properties qq plots 469
plot rows 177
plot symbol at average 563
plot types 56, 205, 211, 217, 225, 234, 246, 251, 257, 263, 269, 278, 285, 288, 290, 307, 309-310, 319, 323, 339, 342, 349, 357, 371, 405, 410, 417, 423-424, 439, 452-453, 473, 485, 495, 513, 521, 526, 674, 691
plot width 250, 305
plot window 24
plot winidow 19
PlotCall Import 886
plots 205, 211, 217, 225, 234, 246, 251, 257, 263, 269, 278, 319, 323, 339, 371, 405, 410, 417, 423-424, 439, 452-453, 473, 485, 495, 513, 521, 526
PLT 1010
PLT import 886
PM 764, 846
PNG 1010
PNG export 903, 1172
PNG import 886
PNG Options 1172
PNG transparency 1172
pointer coordinates 35
polar 319
polar angle axis 707, 720
polar angle magnitude 336
polar bar chart 342-343
polar bar chart properties 343
polar class scatter plot 323
polar function 339-340
polar function data 905
polar function plot properties 340
polar plot properties 320
polar vector plot 335-336
polygon 775, 783
polyline 776, 781
polynomial factors 541

polynomial fit 537, 546
polynomial regression 541, 544
population standard deviation 563
PortInt 962
portrait 182
position 250, 304, 466, 661, 710, 717, 866
position axis 717
position lock 864
position objects 865
positional arguments 958
positive direction 563
positive error bar 563
power fit 537
precision 124
predefined fits 537
preferences 913
prefix 603, 843, 931
print 184, 186, 910
print multiple 912
print setup (worksheet) 180
print worksheet 186
private definitions 967
probability 711
proc list 941
producing a contour map from an array of XYZ data 494
producing a surface map from an array of XYZ data 494
program statements 955
project 53
project file 54
project files 51
projects folder 49
properties 26, 659, 709, 720, 725, 953, 968, 986
properties dialog 244, 333, 387
property copy 861
property inspector 28, 33
property manager 848
Property Manager 28
property manager gone 849
property paste 862

property window 28
public definitions 967
PushButton 972

Q

q-q 469
q-q plot 468-469
q-q plot properties 469
qq plot 469
qq plot properties 469
quality export 1165
quantile 468
quantile-quantile plot 468
quantile quantile plot 469
quantization 1158
quick access toolbar 41
quick access toolbar customize 45, 935
quick watch 943, 949

R

R=F(A) 340
R=F(T) 340
R1 column 336
r2 556
R2 column 336
radar plot 364, 366
radial gradient fill 639, 793
radians 157, 723, 993
radius 1 column 338
radius 2 column 339
radius column 321, 345
radius offset 587
RAM 9
range 354, 362, 436, 729
range dialog 581
read from data column 565
reading ternary diagrams 372
reassign coordinates 700
recent documents 22

recent files 23, 917
recent files (restart required) 917
recently used 22
recently used files 913
recently used list 22
rectangle 778-779, 848, 851
rectangle must fully surround 927
redo 862
redraw 847, 853
reduction method 1157
references 544, 977
refresh 853
refresh data 109
registered serial number 68
registration card 68
regression 538, 541, 544
regression sum of squares 555
relative 424, 713
relative frequency 361, 430
reload 129
reload data 109
reload worksheets 109
REM statements 956
remove program 9
removing graph titles 464, 659
rename 864, 897
rename object 659, 864, 897
render resolution 1115
repeat colors 652
replace 132
requirements 10
resample method 517
reset 431, 849
reset graph to default position 876
reset labels 606
reset managers 33, 847, 849
reset managers to defaults 849
reset position 606
reset rotation 865, 876

reset rotation to default 876
reset windows 849
reset windows to defaults 849
reshape 785
residual mean square 556
residual sum of squares 542, 555
resize objects 863, 865
resolution 124
restore managers to original locations 33
restore windows to original locations 33
results 168
ribbon 12, 40
ribbon customize 45, 935
ribbon wall plot 246
ribbon/wall 247
ribbon/wall plot properties 247
right 136, 183, 584, 593
rose diagram 350, 354, 436
rose diagram custom bin 356, 437
rose diagram data 906
rose diagram properties 351
rotate 233, 277, 397, 482, 865, 874, 876
rotate 2D graph 874
rotate 3D graph 874
rotate by degrees 874
rotate custom angle 874
rotate graph 874
rotate object 864
rotate on screen 874
rotate specific angle 874
rotate with mouse 874
rotate worksheet 177
rotation 233, 277, 397
rounded 672, 678, 684
rounded rectangle 779
rounded square 780
row 124
row and column headers 184
row formats 143

row height 123, 143
row labels 123
row number 208, 214, 228, 249, 254, 260, 272, 296, 313, 321, 345, 392, 408
row numbers 37, 112
rows 145
rows to columns 177
RTF 40
rulers and grid 924
rulers and grids options 924
run 947
run-time errors 947
running average fit 539, 546
running scripts 945
running scripts from the command line 946

S

sample files 51
sample standard deviation 563
save 898-899
save as 899
save data 905
save every 913, 921
save preview image 916
save preview image as 916
saving a color table 652
saving data 76
saving scripts 944
saving worksheet 76
scale 630, 707, 710, 831
scale factor 639, 793
scaling 181
scatter 205
scatter plot 205-206, 257, 259, 703
script 941
script manager 31, 92, 848
script recorder 12, 951
Scripter 9, 941
Scripter BASIC language 955

Scripter help 976
Scripter windows 941
scripting references 977
scripts 943, 945
sdts 1033
SDTS import 886
second line label 463, 595
seconds 764, 846
seg 1070
seg import 1115
select 792
select a color 653, 801
select all 791-792, 864
select case 957
select columns 579
select columns dialog 579
select date/time 764
select deselected objects 793
select entire worksheet 122
select entire worksheet button 37, 112
select objects 25, 790
select overlapping objects 790
select plot data 191
select plot type 191, 670
select plots 695
select tool 773
select worksheet 191
selected 848, 852
selected fit 537
selected objects only 905
selecting cells 119-123
selecting objects 790
selection 792, 865
selection box select 792
selection invert 793
separator 185, 602, 842
sequence number 208, 214, 228, 249, 254, 260, 272, 296, 313, 321, 345, 392, 408
serial number 68

set 3D fill style 639, 793
set class symbols at same time 690
set class symbols to range of sizes 690
set contour level 513
set custom bin 356, 437
set custom bin value 356, 437
set date format 762, 844
set date/time format 762, 844
set image 433, 657
set label date/time format 762, 844
set level 513
setup 180
sheet 1143
shift 542
shortcut keys 42
shotpoint locations 1070
show all 848
show all managers 847
show contours 38
show contours in grid window 38
show convert to 2D warning 930
show convert to 3D warning 930
show grid nodes in grid window 38
show help id 913
show help id (restart required) 913
show label 455, 475
show labels 269, 737
show legend change warning 931
show next statement 950
show nodes 38
show nodes in grid window 38
show options 905
show splash screen 913, 930
show ticks on bottom 707, 729
show ticks on inside 731
show ticks on left 731
show ticks on outside 731
show ticks on right 731
show ticks on top 710, 729

show welcome dialog 930
SHP 1010
SHP export 903
SHP import 886
sin 156, 992
single 962
size 867
size and color 1155
size column 228, 272, 392
size lock 864, 867
size objects 863, 865
skew 171
slice-to-label distance 455, 475
slice properties 460, 462, 480
slices 455, 475
SLK Files 102, 1078
sort 146
sort data 147
sorting 146
sorting data 146
sp1 1070
sp1 import 1115
space delimit 1022
spacing 95, 729
spacing value 95, 729
sparse 743
special characters 83
specify background properties for a graph 659
specular 531
speed 359
speed bins 359
speed column 360
spider plot 364
spline 781, 783
spline polygon 783
spline polyline 781
spline smoothing fit 537, 546
spread across plot 643, 798
square 672, 678, 684, 778-779

square root 158, 994
SSe 555
stack 943, 951
stacked bars 294, 343
stacked pie charts 472
stacking 297, 345
standard axes 709
standard axis 83, 707, 710
standard deviation 158, 175, 556, 563, 994
standard error of the mean 175, 563
star plot 364
start angle 457, 478
start at 358
start grapher with graph wizard 49
start grapher with only plot 49
start grapher with only worksheet 49
start grapher without plot 49
start grapher without worksheet 49
start lines horizontally 213, 252
start lines vertically 213, 252
start major ticks at 733
start recording 93
start tick date/time 729
start tick value 729
start up 51
starting grapher 49
starting position 710, 720
statements 955
statistical plots 453, 473
statistics 163, 168, 546, 554
statistics (worksheet) 163
statistics dialog 168
statistics references 176, 558
statistics results 168
statistics results dialog 168
status 35
status bar 19, 35, 790, 848, 947
step factor 582, 590
step into 949

step lines 213, 252
step out 950
step over 949
step plot 211, 213, 246, 251-252, 704
step plot properties 213, 252
step row value 206, 213, 226, 247, 252, 259, 270, 294, 311, 320, 343, 351, 358, 375, 390, 406, 425, 442
step to cursor 950
stiff plot 417, 724
stiff plot x axes 710, 724
stock pattern 640, 794, 801
stop 948
stretch 641, 796
string 962
style 633, 847, 923
style options 294
subroutines 959
suffix 604, 844, 931
suggested reading 977
sum 156, 992
sum of squares 555
summation plot 674, 691
superscript 603, 843
superscripted 603, 843
support 69
surface data map 513
surface function map 526
surface grid map 521
surface map 38, 514-515, 518, 522-523, 526-527, 531, 533
surfer ASCII 1050
surfer text grid 1050
swap wheel zoom/scroll 923
switch 177
switch back to old menus 49
switch columns and rows 177
switch rows and columns 177
SYLK Files 1078
symbol 211, 217, 219, 229, 257, 263, 265, 273, 323, 340, 375, 393, 611, 614-615, 777

symbol angle 609, 838
symbol color 614
symbol color dialog 614
symbol column 607, 837
symbol frequency 206, 213, 219, 252, 259, 265, 320, 340, 546, 607, 836
symbol palette 611
symbol plot 206, 259
symbol properties 813
symbol properties defaults 931
symbol size 687
symbol sizes 690
symbol table 611, 615, 840
symbol table file format 615
symbols 446
symbols in legend 672, 678
symmetrical error bars 563
syntax examples 976
system requirements 10

T

tabbed documents 19, 923-924
tabbed managers 34
table 611
tan 156, 992
technical support 69
template 65, 189, 201, 806, 819
template alternatives 203
template graphs 67, 191, 201
tension factor 550
ternary 371-372, 375, 377, 389, 590, 710, 769
ternary axis 372, 709, 715, 769
ternary axis advanced 769
ternary axis tips 768
ternary class 377
ternary class plot 377
ternary diagram 371-372, 389
ternary diagram properties 375
ternary plot 377
test template 817

text 774, 956, 972
text editor 84, 806
text labels 735, 765
text linked to worksheet 813
text margin 774
text to number 178
TextBox 972
texture map 517
TGA 1011
TGA export 903
TGA import 886
theme 923
thickness 458, 479
third quartile 440
thousands 931
thousands separator 136, 141, 602, 842
three-minute tour 16
through origin fit 537
tick label frequency 735
tick label range 740
tick label source 86
tick labels 729, 735, 759, 767
tick length 729
tick line 632, 833
tick line properties 632, 729, 833
tick mark labels 735, 762, 765
tick mark spacing 85, 95
tick marks 95, 707, 725, 729
tick maximum 729
tick minimum 729
tick range 729
tick spacing 710, 731
ticks 729
TIF 1011
TIF export 903
TIF import 886
tile 639, 793, 848, 912
tile horizontal 848, 854
tile vertical 848, 855

time 185, 572, 713, 764
time format 104, 136, 602, 842
time formatting 102, 757, 762, 844
time labels 737
tips about templates 202
title 83, 464, 659, 681, 685, 710, 721, 725
title on side 716
toggle break 950
tolerance 927
toolbar 40-41
toolbars 19, 849
tools options 913
top 183, 867
top-level legend 679
total area 705
total digits 931
total page count 184
towards reference 567
trace 950
trackball 874
transform 148
transparency 903, 1158
transparent 640, 794
transpose 177
trigonometric functions 157, 993
truncate 912
turn off display of managers 849
tutorial 71-73, 76, 78-81, 83, 85-86, 89-91, 93-96, 99
tutorial introduction 71
tvp 1033
TXT 1021
TXT files 102
type 964
type library 954
types of files 53

U

uncheck managers 849
undo 809, 862

undo levels 916
undo rotation 876
ungroup 864, 872
ungroup objects 872
unhide columns 145
unhide rows 145
unhiding columns 141
unhiding rows 143
unicode 84, 806
unidirectional 354
uninstall 11
units 721
up fill style 409
update 68
update data 108-109
update graph 108-109
update interval 913, 920
update interval (days) 913
update worksheet 108
updates 914
upgrade 68
upper level properties - confidence 627, 828
use an array as a grid 494
Use application-supplied background transparency 1172
use automatic bins 354, 435
use color for ribbon 627, 828
use color for symbols 631, 832
use column criteria 578
use criteria 576
use customized bins 354, 435
use data range 230, 274, 394
use date/time spacing 732
use decimal comma 600, 840
use fixed range 231, 275, 395
use graph coordinates for export 905
use incremental size 690
use null criteria 577
use slice fill color 464, 596
use symbols for bubbles 226, 270, 390

use worksheet labels 592
user-defined dialog boxes 972
user-defined types 964
user defined date/time format 762, 844
user input 970
user interface 19
UserDialog editor 970
UserDialog example 973
UserDialog items 972
uses 967
USGS 1038
using a template graph 65, 189, 201
using collection objects 984
using Grapher 65, 189
using Grapher objects 978
using the graph wizard 191

V

variable values 949
variables 962-963, 965
variance 176
variant 962
VBA 975
vector 336
vector pattern 639, 793
vector pdf 903
vector plot 336, 410
vector plot in 3D 411
vector plot polar 336
vector plot properties 413
vert drop axis 206, 226, 259, 270, 390
vert drop line properties 206, 259, 627, 828
vertical 867
vertical alignment 586, 864
vertical bar chart 294, 703
vertical bar step 567
vertical category bar chart 286
vertical centering 182
vertical drop lines 209, 231, 262, 275, 395

vertical error bars 563
vertical floating bar chart 311
vertical histogram 425
vertical offset 590
vertical ruler 925
view 847
view menu 847
view menu commands 847
view page 850
view tab 847
viewing grid nodes 37
visibility 25
visual BASIC compatibility 974
visual look 923

W

W 863, 867
wall fill style 717
watch 943
weighted average fit 539, 552
weights 551
welcome 49
welcome dialog 53
welcome to Grapher help 12
wend 958
what is this file? 53
wheel mouse 850-851, 853
wheel zoom/scroll 850
while wend 957
whisker label 448
width 141, 246, 250, 298, 315, 346, 428, 628, 828, 864
width of object 863
wind chart 354, 357, 435
wind chart custom bin 356, 437
wind chart data 906
wind chart legend 672, 678
wind chart legend defaults 932
wind chart legends 672, 678
wind chart properties 358, 362

wind direction 358
wind legend 358
wind speed 359
wind speed bins 362
wind speed range 362
window 847
window arrangement 847
window layout 33, 847
window style 847
window width 550
windows 941
windows metafile description 1083
Windows stock pattern 646, 801
wire frame 1 226, 270, 390
wire frame 2 232, 276, 396
wizard 191
WKx files 102
WMF 1011, 1083
WMF export 903
WMF import 886
working with scripts 943
worksheet 102, 108-109, 207, 213, 227, 248, 253, 259, 271, 295, 312, 320, 344, 351, 359, 376, 391, 407, 426, 443, 455, 476
worksheet alignment 137
worksheet automation 987
worksheet background 138
worksheet cell link 813
worksheet cell properties 138
worksheet cells 136
worksheet columns 207, 214, 227, 248, 254, 260, 271, 296, 312, 321, 344, 352, 359, 376, 392, 407, 426, 444
worksheet data 116, 1078, 1085
worksheet date 104
worksheet date time format 104
worksheet document 35, 110
worksheet format 104
worksheet grid lines 727
worksheet labels 765, 822, 999
worksheet line properties 728

worksheet manager 30, 33
worksheet name 37, 112
worksheet number format 140
worksheet path 915
worksheet rows 208, 214, 228, 249, 254, 260, 272, 296, 313, 321, 345, 351, 358, 375, 392, 408, 427, 442, 462, 585, 591, 594
worksheet sort 146
worksheet specifications 124
worksheet statistics 163
worksheet time 104
worksheet window 35, 110, 112, 116
worksheets 109
worksheets found 1143
WPG 1007
WPG export 903
WPG import 886
writing scripts 944
wysiwyg text 806

X

X 865-866
X axis 206, 215, 219, 226, 247, 255, 259, 265, 270, 303, 313, 390, 406, 425, 447, 707, 709, 716
X column 208, 214, 228, 249, 254, 260, 272, 296, 313, 375, 392, 408
X first value 500
X last value 500
X offset 466, 587, 593, 661, 707, 717, 724
X only 717
X position 707, 713
X rotation 482, 876
X scale 542
X shift 542
X=F(T) 220, 266
X1 column 415
X2 column 415
XLS files 102, 1085
XLSX files 1085
xor 156, 993
xyz dx dy dz vector plot 411
XYZ function map 499

xyz xyz vector plot 411

Y

Y 864, 866

Y axis 209, 215, 221, 229, 250, 255, 261, 266, 273, 302, 316, 393, 410, 428, 447, 709, 712

Y axis clipping 546

Y column 208, 214, 228, 249, 254, 260, 272, 296, 377, 392

Y first value 500

Y last value 500

Y offset 467, 587, 593, 662, 707, 716, 724

Y only 717

Y position 713, 720

Y rotation 482, 876

Y=F(X) 219, 265

Y=G(T) 223, 268

Y1 column 313

Y2 column 313

year 764, 846

Z

Z axis 209, 229, 261, 273, 393, 709-710

Z column 208, 228, 260, 272, 377, 392

Z function 500

Z rotation 482, 876

Z1 column 415

Z2 column 415

zero 297, 428

zoom 847

zoom in 847, 850

zoom inset 788

zoom out 847, 851

zoom page 850

zoom percent 852

zoom rectangle 851

zoom selected 852