

# 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](http://MyAccount.GoldenSoftware.com).

Register your **Grapher** product key online at [www.GoldenSoftware.com](http://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.

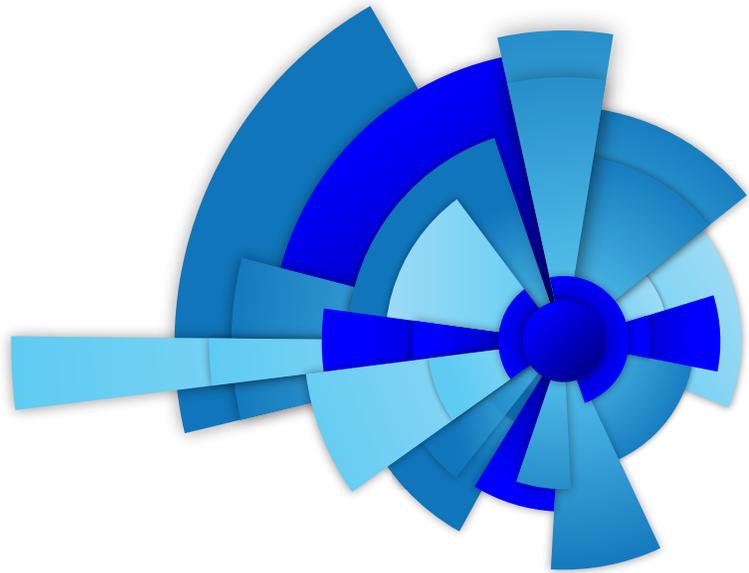
For future reference, write your product key on the line below.

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**Grapher™**

**User's Guide**

The Ultimate Technical Graphing Package



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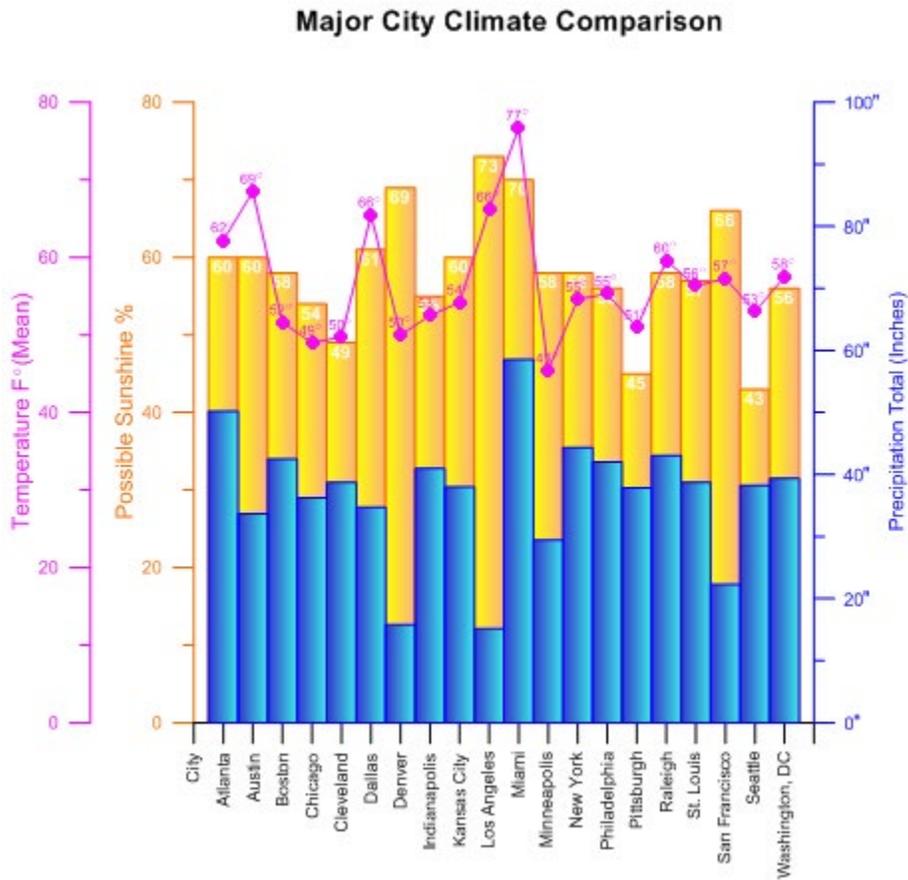
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# Chapter 1 - Introducing Grapher

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, 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 14** in the same location as any previous version of **Grapher**. **Grapher 14** can coexist with older versions (e.g. **Grapher 13**) as long as they are installed in different directories, which is the default.

To install **Grapher** from a download:

1. Log into Windows under the account for the individual who is licensed to use Surfer.
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 14** from the list of installed applications. Click the *Uninstall* button to uninstall **Grapher 14**.

### Windows 8

From the *Start* screen, right-click the **Grapher 14** 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 14** 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 14**, and then click *Uninstall*. To uninstall **Grapher** from the Windows Control Panel, click **Programs | Programs and Features**. Next select **Grapher 14** 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

This is an overview of some of **Grapher 14's** new features.

### User Friendly

- Improved adding and editing [fit curves](#) in the **Property Manager**
- Dialogs always appear in the center of the window
- Change the [visibility](#) for multiple objects at one time
- Create plots from [data in rows](#) or columns

## Graph Features

- Create [Durov and Durov Class](#) plots
- Create [variable width](#) bar charts with axis units
- Save/Load [weights](#) for weighted average fit curves
- Connect line plots with a [smooth line](#)
- Specify the number format for displayed, copied, or inserted [fit statistics](#)
- [Fill](#) bar charts with different colors for bars with values greater than the base value and less than the base value.
- Create custom [page sizes](#)
- Create multiple pages in a single [plot document](#)

## Import and Export Improvements

- Import [Esri Personal Geodatabase MDB](#) files
- Import [Esri File Geodatabase GDB](#) files
- Export [ASCII Database DBF](#) files
- Export [GPS Exchange GPX](#) files

## Automation

- Create Durov, Durov class, extended Durov, and extended Durov class plots
- Apply separate fills to bars above and below the base value
- Connect line plots with a smooth line
- Create plots from data in rows

## 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. The 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 *Forums* or *Knowledge Base* buttons in online help to research a question or to post a question.
- Click the **File | Feedback** commands to send a problem report, suggestion, or information request by email.
- Search our website at [www.goldensoftware.com](http://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](#), [Knowledge Base](#), and Forums.
- The Golden Software website has a variety of resources including [training videos](#), a [support forum](#), a [blog](#), a [user image gallery](#), and a variety of [links and downloads](#).
- The **Grapher** web help can be viewed in a browser window by navigating to [grapherhelp.goldensoftware.com](http://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](http://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](http://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 online help. Information about each command and feature in **Grapher** is included in the online help. In the event the information cannot be located in the online help, other sources of **Grapher** help include our support forum, frequently asked questions, knowledge base, and contacting our technical support engineers.

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.

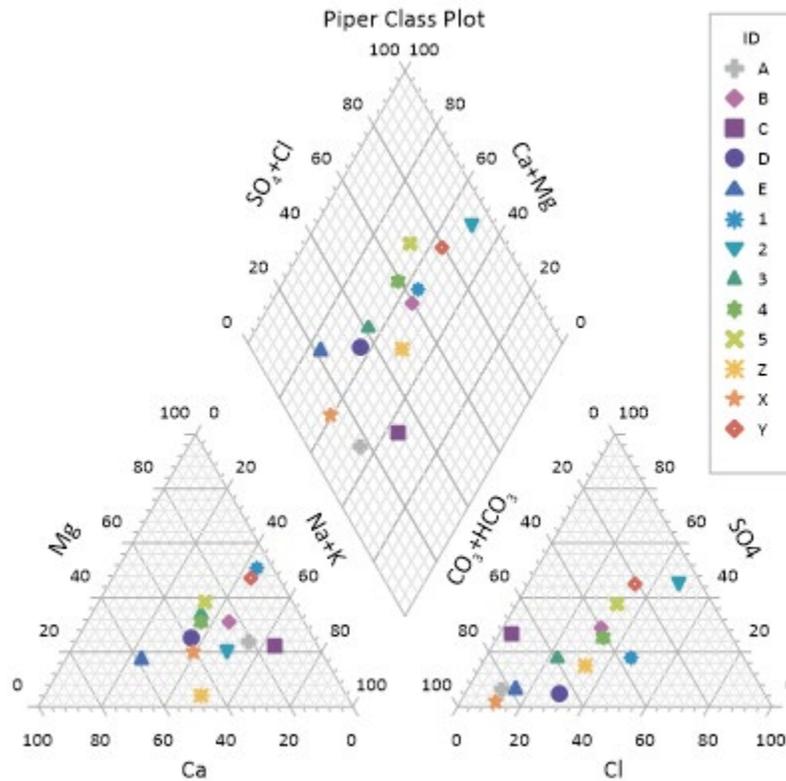
### Three-Minute Tour

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

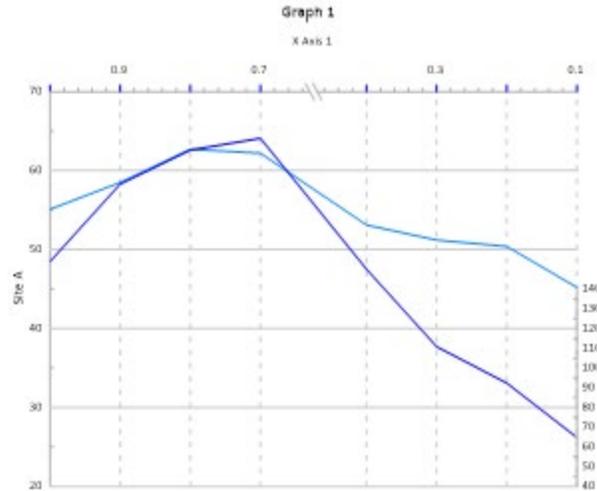
Tasks can be automated in **Grapher** using Golden Software's **Scripter** program or any ActiveX Automation-compatible client, such as Visual BASIC. A script is a text file containing a series of instructions for execution when the script is run. **Scripter** can be used to perform almost any task in **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.



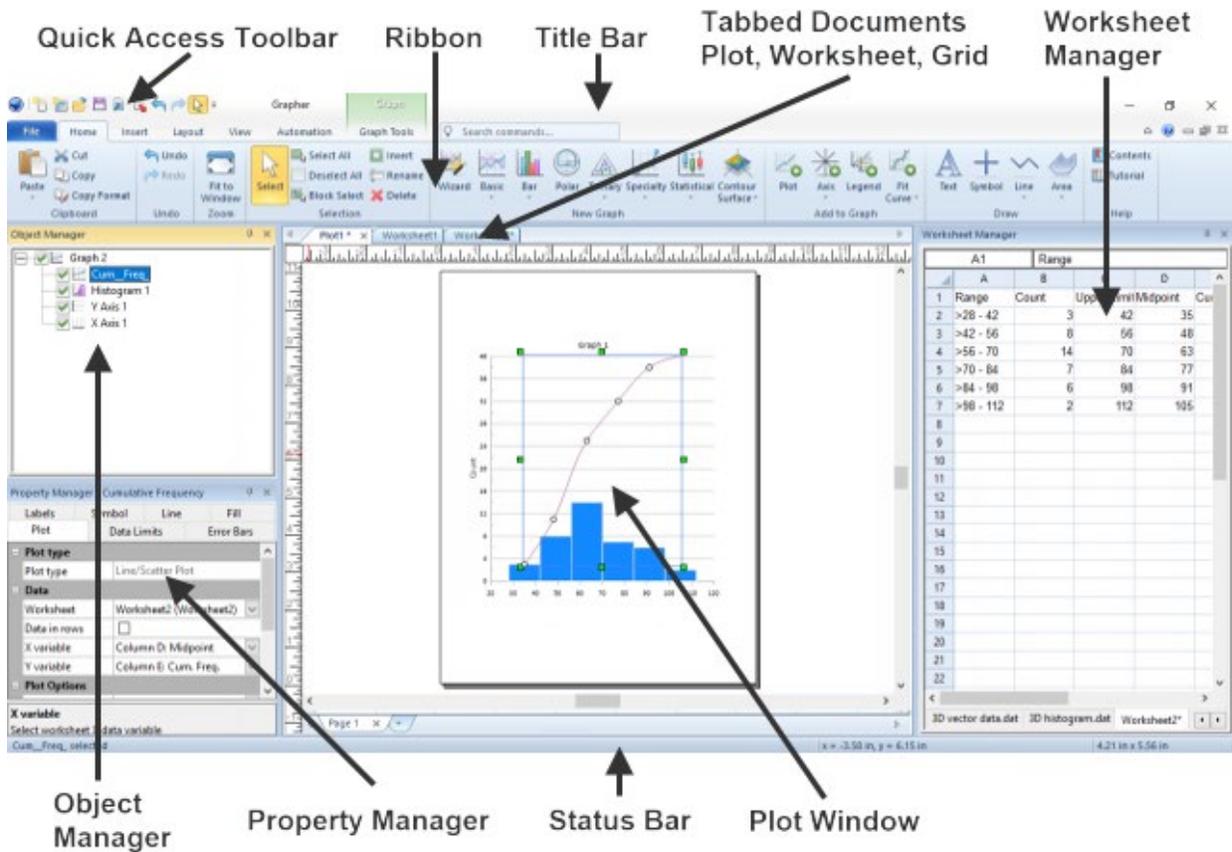
*The axis properties.bas script edits all of the properties of an axis, including the tick marks, grid lines, and breaking the axis.*

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

1. Open **Scripter** by navigating to the installation folder, C:\Program Files\Golden Software\Grapher 14. 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 14\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
<a href="#">Ribbon</a>	The ribbon contains the commands used to run <b>Grapher</b> . Some commands are unique to the <a href="#">plot document</a> , <a href="#">worksheet document</a> , and <a href="#">grid document</a> .
<a href="#">Tabbed Windows</a>	Multiple plot windows, worksheet windows, Excel worksheet windows and grid windows can be displayed as tabs. Click on a tab to display the window.
<a href="#">Plot Window</a>	The plot window contains the graphs and other graphics in one or more pages.
<a href="#">Worksheet Window</a>	The worksheet window displays the contents of the plot data sources and data files.
<a href="#">Status Bar</a>	The status bar shows information about the activity in <b>Grapher</b> . 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.

<a href="#">Object Manager</a>	<p>The <b>Object Manager</b> contains a hierarchical list of objects in a <b>Grapher</b> plot window; these objects can be selected, arranged, and renamed in the <b>Object Manager</b>. The <b>Object Manager</b> is initially docked on the left side above the <b>Property Manager</b>.</p>
<a href="#">Property Manager</a>	<p>The <b>Property Manager</b> 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 <b>Property Manager</b> is initially docked on the left side below the <b>Object Manager</b>.</p>
<a href="#">Script Manager</a>	<p>The <b>Script Manager</b> controls scripts that are recorded and run within <b>Grapher</b>. Right-click in the <b>Script Manager</b> to see relevant menu commands for opening, saving, and running scripts. The <b>Script Manager</b> is hidden by default.</p>
<a href="#">Worksheet Manager</a>	<p>The <b>Worksheet Manager</b> contains a view of all data loaded into <b>Grapher</b>. Edits made in the <b>Worksheet Manager</b> are automatically reflected in the graph. Right-click in the <b>Worksheet Manager</b> 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 <b>Worksheet Manager</b>. When a GPJ file is opened, the embedded data is displayed in the <b>Worksheet Manager</b>.</p>

## 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

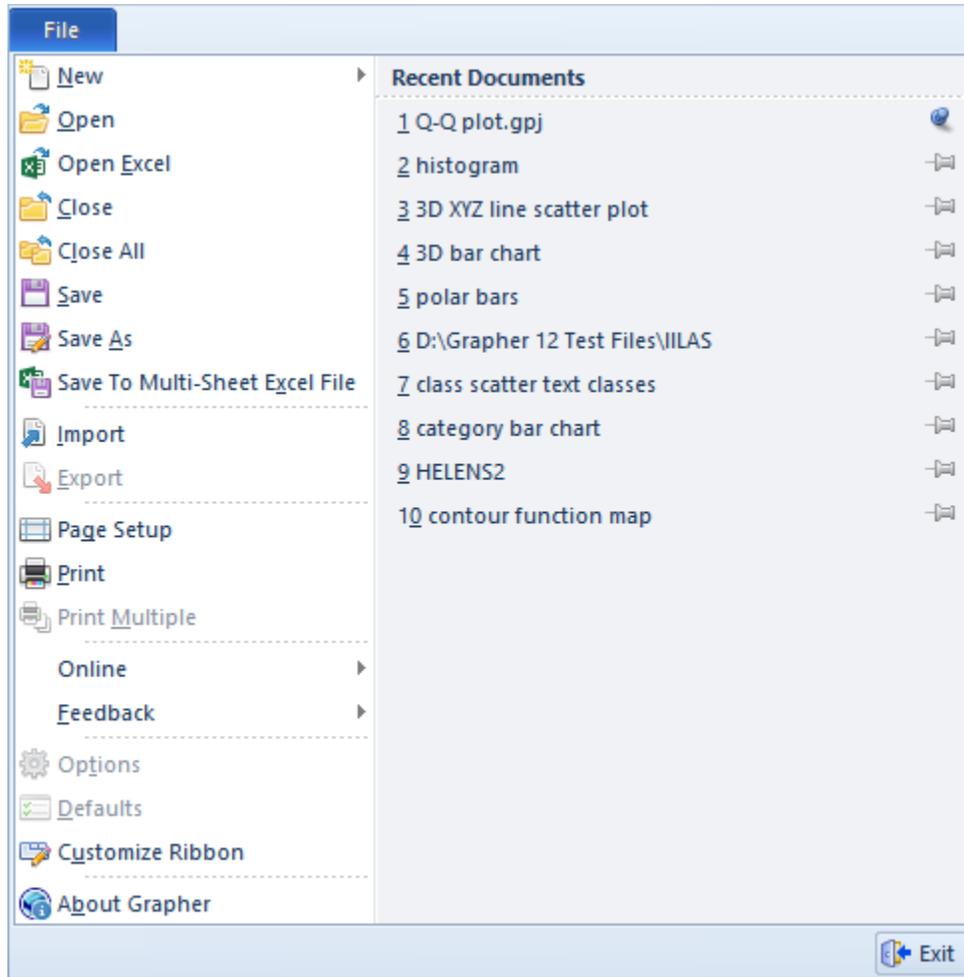
The [Quick Access Toolbar](#) is the toolbar at the top of the screen. This toolbar can be customized to include any commands. To [customize the Quick Access Toolbar](#), right-click on the ribbon and select **Customize Quick Access Toolbar**. Select any command and drag it to the desired place on the 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 <b>Grapher</b> version number.
Home	Contains the commands for creating graphs as well as some of the most commonly used commands.
<a href="#">Insert</a>	Contains the commands for adding and editing drawn objects, OLE objects, images, and inset zoom objects.
<a href="#">Layout</a>	Contains the commands for editing the page layout and printing options as well as the arrangement of the objects on the page.
<a href="#">View</a>	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.

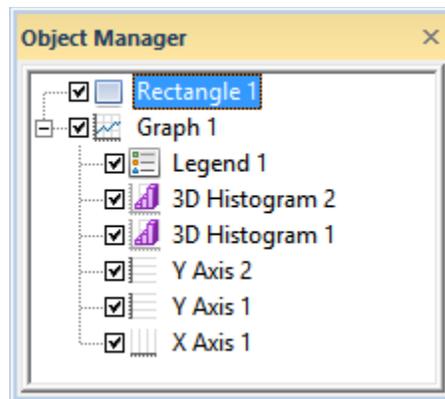
### Tab View

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 plot window. The **Object Manager** 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

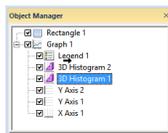
Click on the object name to select an object and display its properties in the [Property Manager](#). The plot window updates to show the selected object with a selection bounding box and the status bar displays the name of the selected object. To select multiple objects, hold down the CTRL key and click 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

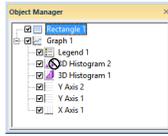
Select the object and then click again on the selected object (two slow clicks) to edit the object name. You must allow enough time between the two clicks so the action is not interpreted as a double-click. Enter the new name into the box. Alternatively, right-click on an object name and click **Rename 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.

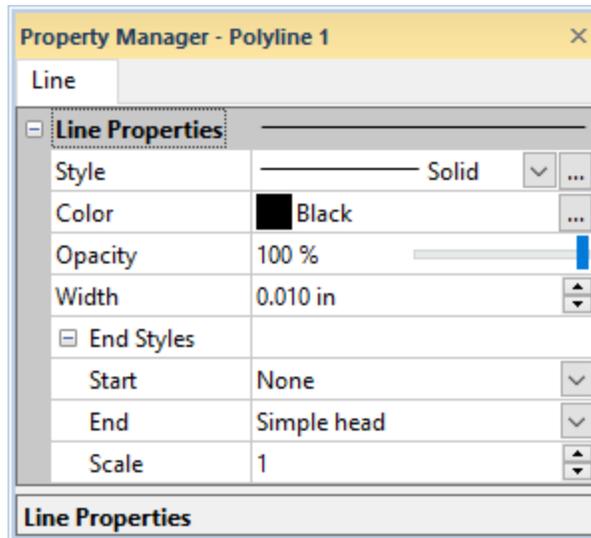
Press ALT+ENTER to access the [Property Manager](#) for the selected item. If the selected item cannot be collapsed, such as a plot or axis, you can also press ENTER to access the object's properties. If the selected item can be collapsed, such as a group or graph, press ENTER to collapse or expand the 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  $\oplus$  or minus  $\ominus$  to the left of the name. To expand a section, click on the  $\oplus$  button. To collapse a section, click on the  $\ominus$  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  $\updownarrow$  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* properties and 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., *Plot Properties*, 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.

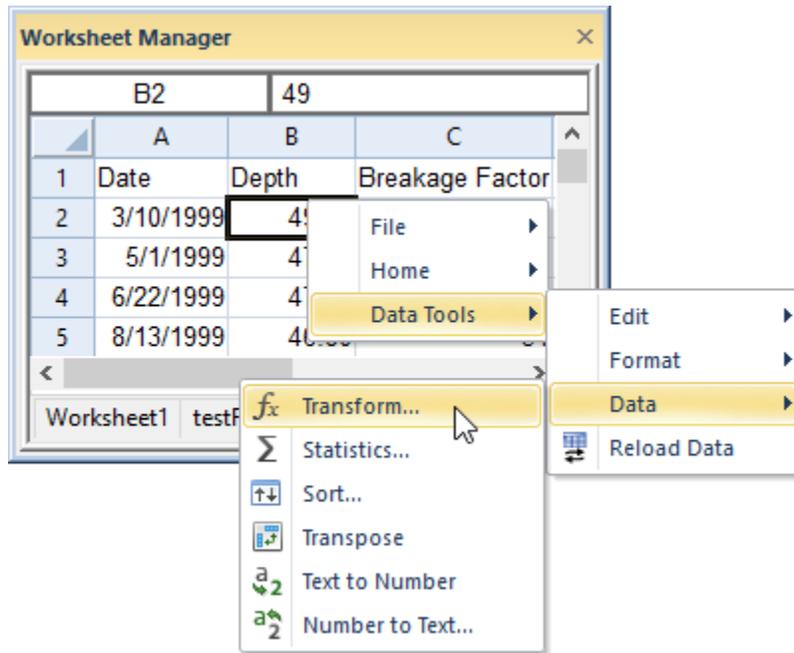
### Property Manager Information Area

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

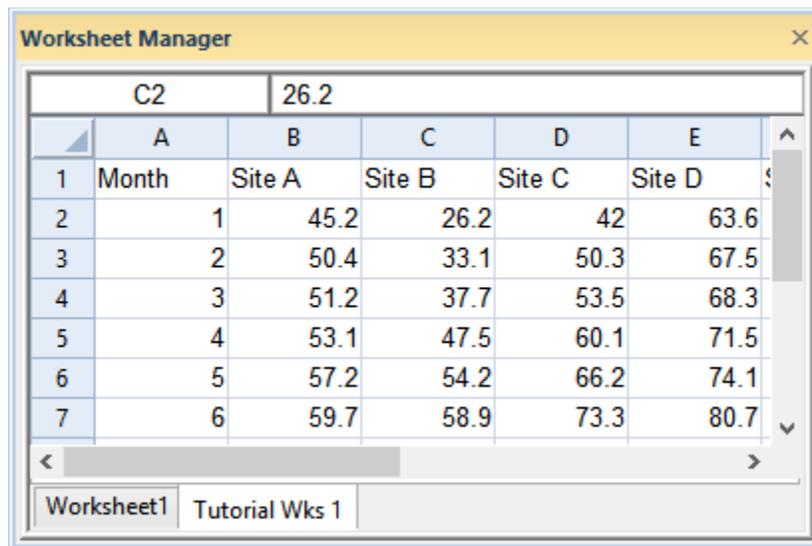
The **Worksheet Manager** contains a view of all data loaded into **Grapher**. Multiple data files are displayed in a tabbed format. By default, the **Worksheet Manager** appears at the right of the **Grapher** window.

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 Tools menu 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.

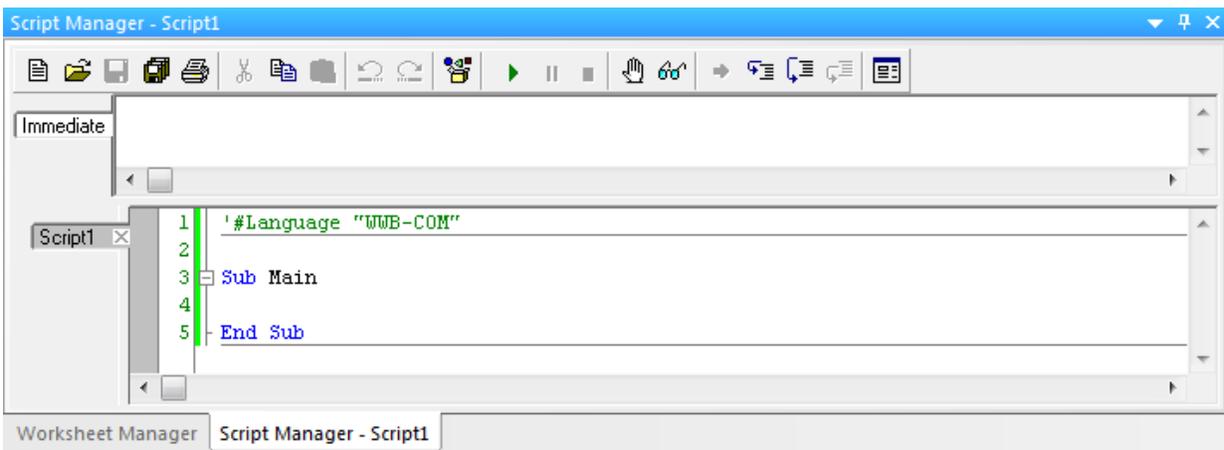


You can see all data used in all open plot windows in the **Worksheet Manager**.

## 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** 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

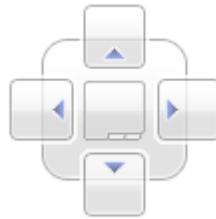
Drag the sides of a floating plot window, worksheet window, manager, toolbar, or menu bar to change its size. If a window or manager is docked, its upper and lower bounds are indicated by a  or  cursor. Move the cursor to change the size.

### 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.*

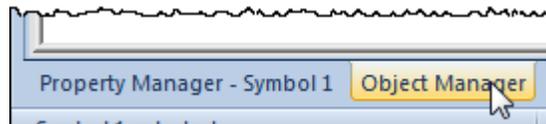
## Tabbed Managers

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.



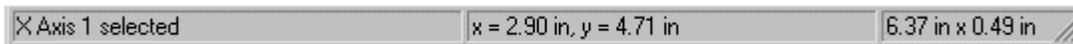
*Click on the manager's tab and drag the cursor to a new position to separate the managers.*

## 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 <b>Grapher</b> version number.
Home	Contains clipboard, undo, and graph creation commands.
<a href="#">View</a>	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.

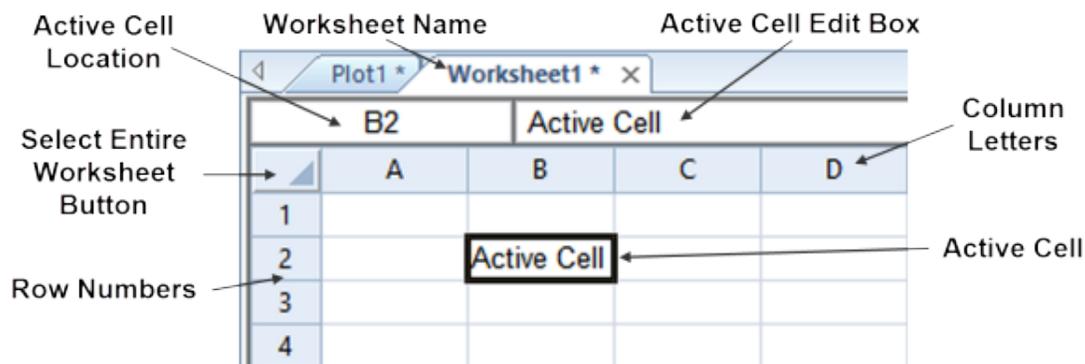
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The Application/Document Control menu commands control the size and position of the application window or the document window.

### 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.

<a href="#">Column Letters</a>	The column letters identify a column in the worksheet.
<a href="#">Row Numbers</a>	The row numbers identify a row in the worksheet.
<a href="#">Active Cell</a>	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.
<a href="#">Active Cell Location</a>	The active cell location is specified by column letter and row number.
<a href="#">Active Cell Edit Box</a>	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.
<b>Worksheet Name</b>	The worksheet name displays the data file name or the worksheet number if the data file has not been saved.
<a href="#">Select Entire Worksheet Button</a>	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 <b>Grapher</b> version number.
Home	Contains commands for creating graphs and links to the tutorial and help file.
<a href="#">View</a>	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.

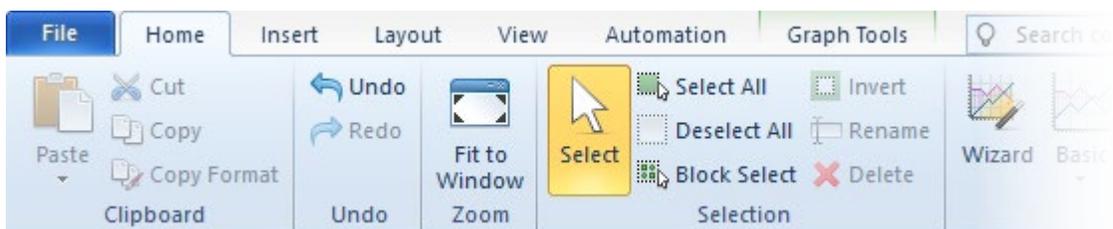
### Save and Print

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.

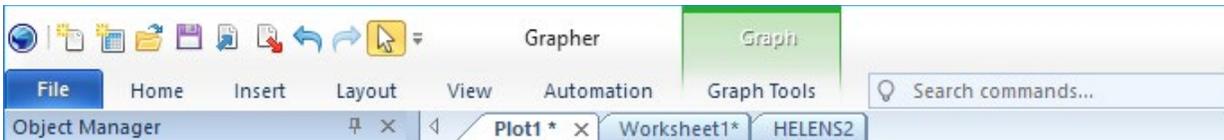
Above the Ribbon are a number of tabs, such as **Home**, **Automation**, and **Graph Tools**. Clicking or scrolling to a tab displays the options located in this section of the ribbon. The tabs have commands that are organized into a group. For instance, all the script related commands are on the **Automation**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

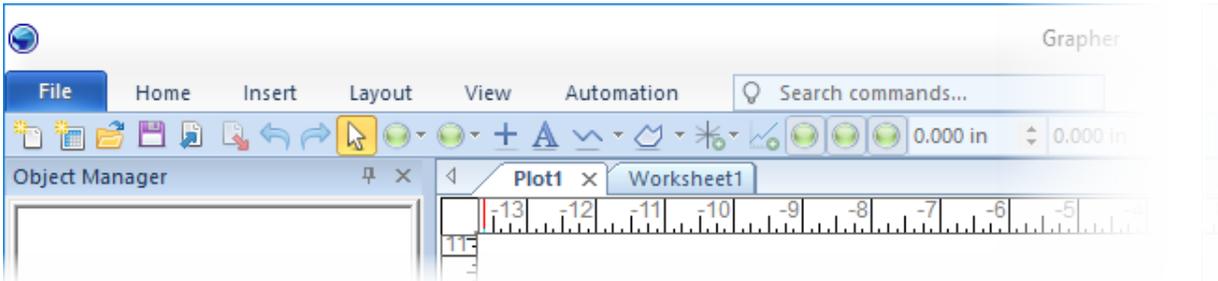
The Quick Access Toolbar is at the top of the **Grapher** window. This toolbar has frequently used commands and can be customized by the user. The commands in the Quick Access Toolbar are the same regardless of the type of window displayed in **Grapher**.



*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 <b>Grapher</b> .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 <b>Grapher</b>

#### 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

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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 <b>Grapher</b>
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 <b>Grapher</b> 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

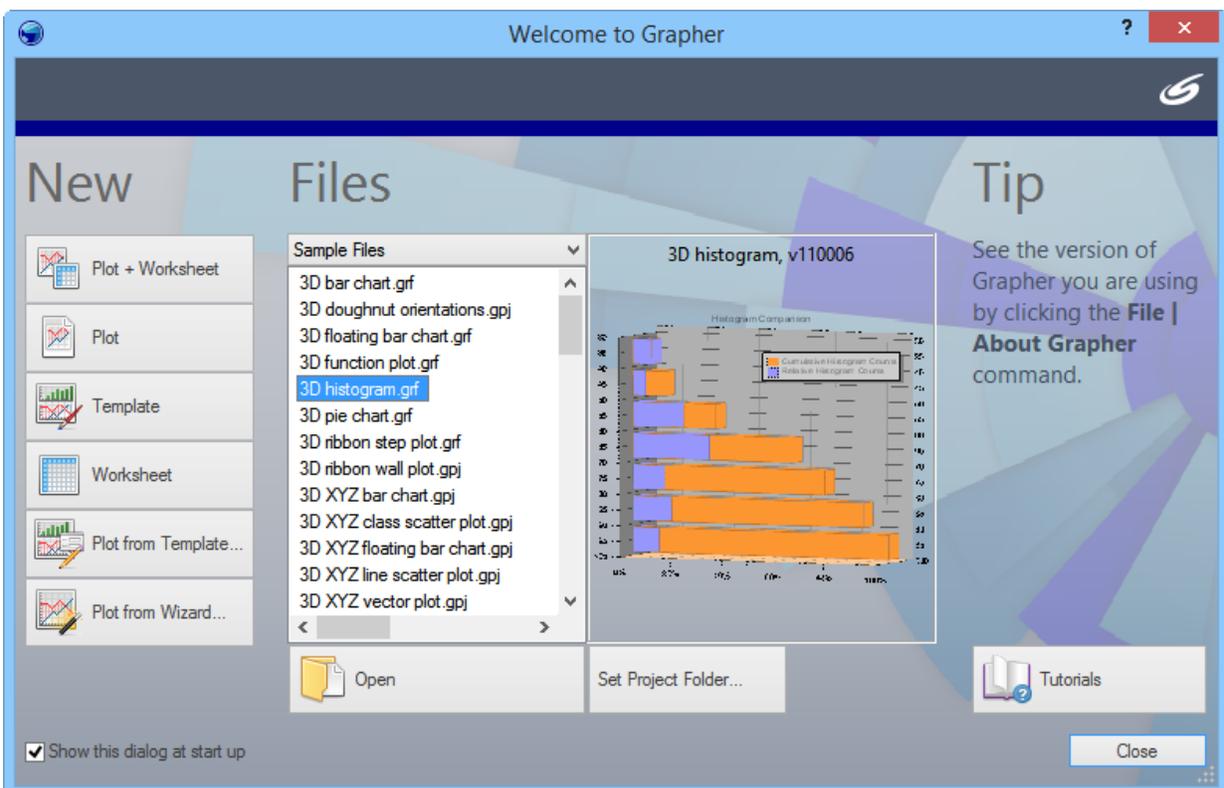
Several options exist to maximize the plot window display space. See some common options below.

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 **Welcome to Grapher** dialog appears. The **Welcome to 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 14\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 *Set Project 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\\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 startup* 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 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 .XLSX 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.

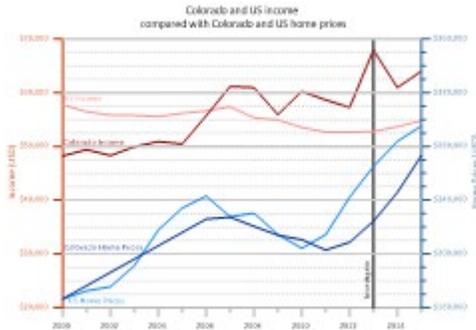
Other database formats can be imported into **Grapher's** worksheet. Click the **File | Open** command. In the [Open](#) dialog, click the *Database* button. Step through the dialogs to import the file and the database is converted into a worksheet format. These files cannot be saved in their native 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.

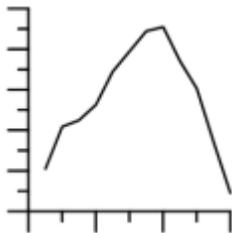
## Plot Types

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** group by category:

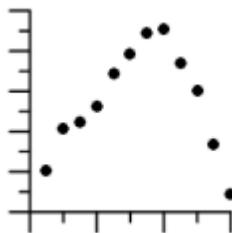


### Basic Plots

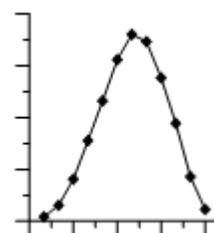
Basic plots include 2D line plots, scatter plots, line/scatter plots, step plots, function plots, bubble plots, and class plots. In most cases, two variables are displayed on two axes. The Basic plots also include 3D ribbon plots, 3D wall plots, 3D step plots, and 3D function plots. In these cases, two 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.



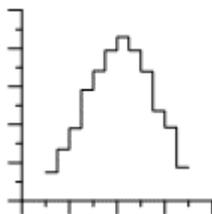
[Line Plot](#)



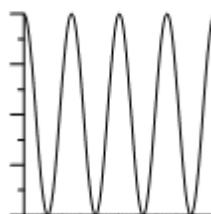
[Scatter Plot](#)



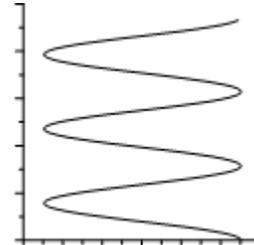
[Line/Scatter Plot](#)



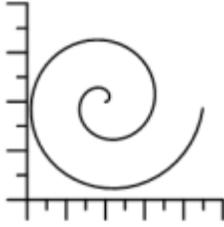
[Step Plot](#)



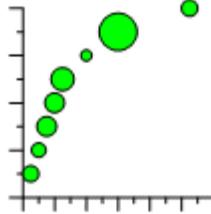
[Y=F\(X\) Function Plot](#)



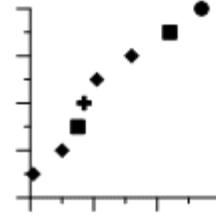
[X=F\(Y\) Function Plot](#)



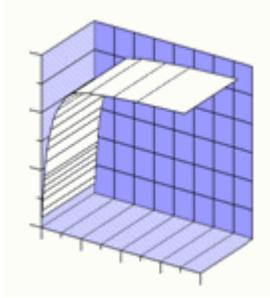
[Parametric Function Plot](#)



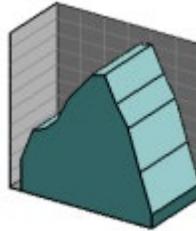
[Bubble Plot](#)



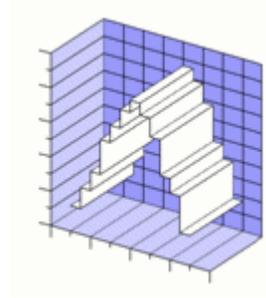
[Class Scatter Plot](#)



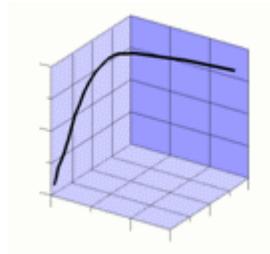
[3D Ribbon Plot](#)



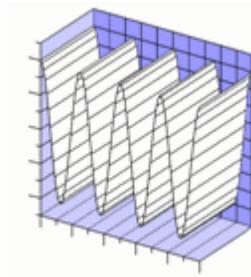
[3D Wall Plot](#)



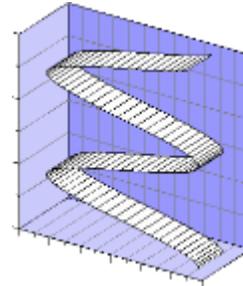
[3D Step Plot](#)



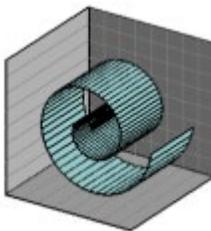
[XYZ Line/Scatter Plot](#)



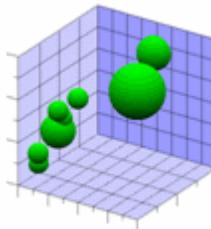
[3D Y=F\(X\) Function Plot](#)



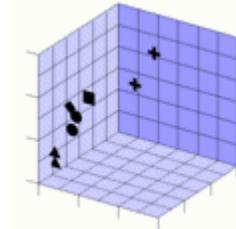
[3D X=F\(Y\) Function Plot](#)



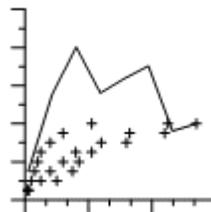
[3D Parametric Function Plot](#)



[XYZ Bubble Plot](#)



[XYZ Class Scatter Plot](#)



[2D Summation](#)

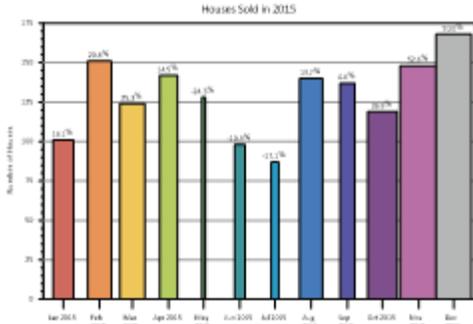
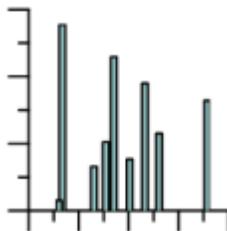


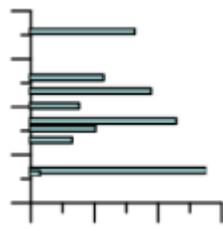
Fig. 3. Houses Sold in 2015. Bar with labels indicates percentage increase/decrease over previous year. Color is the actual percentage increase/decrease over previous year.

### Bar Plots

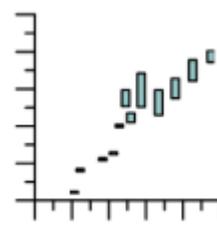
Bar plots include 2D, 3D, or XYZ horizontal and vertical bar charts and floating bar charts. For 2D bar charts, two variables are displayed on two axes. For 3D bar charts, two variables are displayed with a 3D aspect. 2D and 3D bar charts can also be created directly from category data. XYZ bar charts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



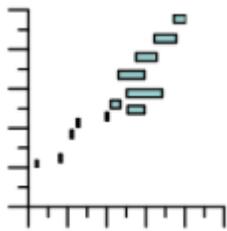
[Vertical Bar Chart](#)



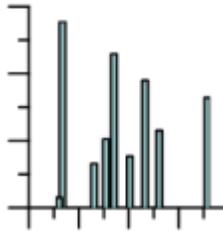
[Horizontal Bar Chart](#)



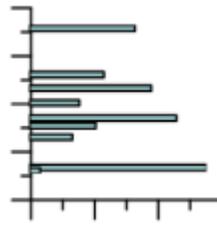
[Vertical Floating Bar Chart](#)



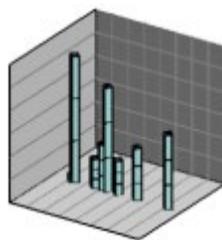
[Horizontal Floating Bar Chart](#)



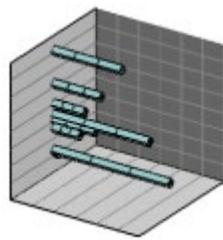
[Vertical Category Bar Chart](#)



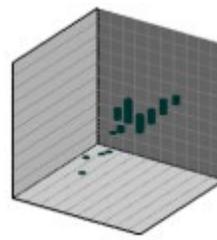
[Horizontal Category Bar Chart](#)



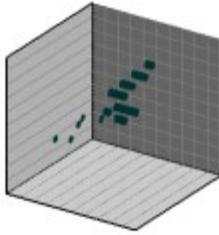
[3D Vertical Bar Chart](#)



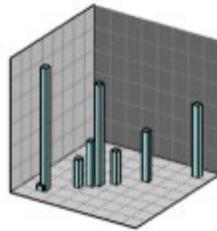
[3D Horizontal Bar Chart](#)



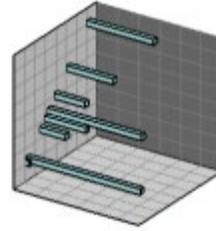
[3D Vertical Floating Bar Chart](#)



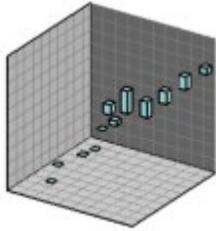
[3D Horizontal Floating Bar Chart](#)



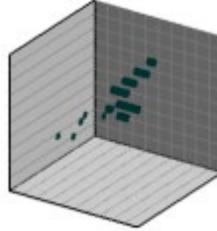
[XYZ Vertical Bar Chart](#)



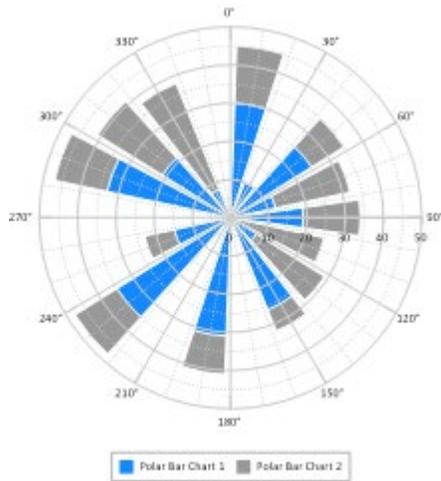
[XYZ Horizontal Bar Chart](#)



[XYZ Vertical Floating Bar Chart](#)

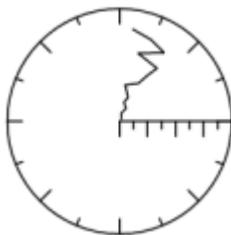


[XYZ Horizontal Floating Bar Chart](#)

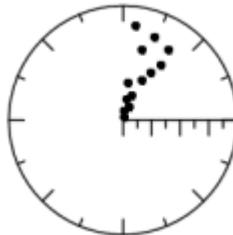


### Polar Plots

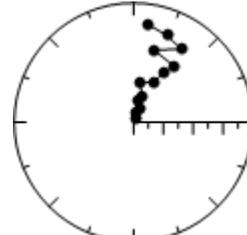
Polar plots include polar line plots, scatter plots, line/scatter plots, class plots, vector plots, function plots, bar charts, rose charts, wind charts, and radar charts. Data are positioned on a circular plot at an angle and a specified distance away from the center location. Rose charts are histograms 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.



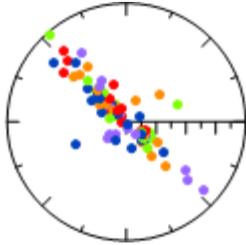
[Polar Line Plot](#)



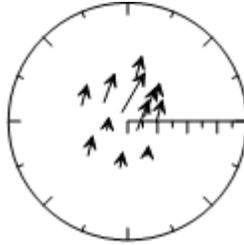
[Polar Scatter Plot](#)



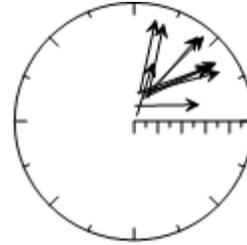
[Polar Line/Scatter Plot](#)



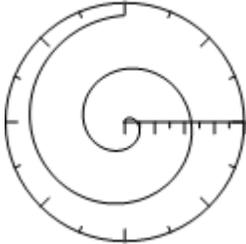
[Polar Class Scatter](#)



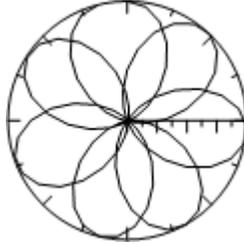
[2-Point Polar Vector Plot](#)



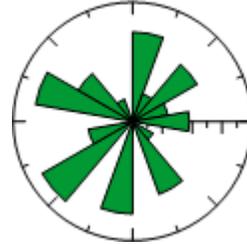
[1-Point Polar Vector Plot](#)



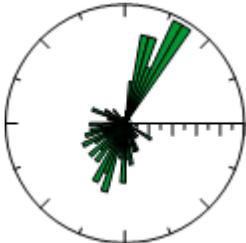
[Function Plot](#)



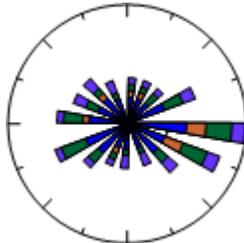
[Parametric Function Plot](#)



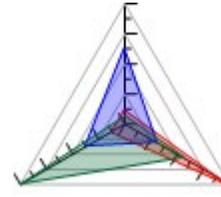
[Polar Bar Chart](#)



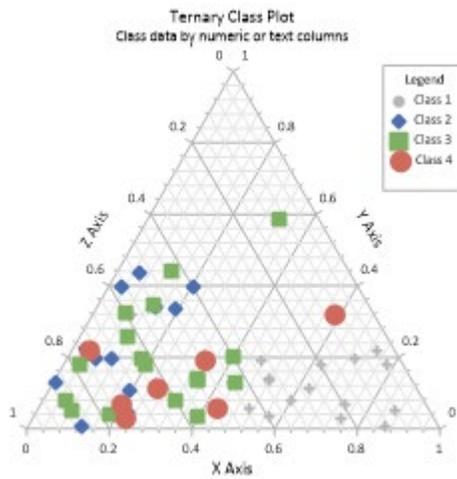
[Polar Rose Chart](#)



[Polar Polar Wind Chart](#)

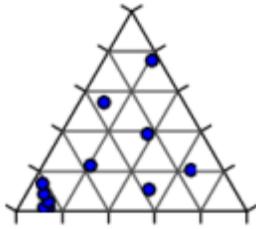


[Radar Chart](#)

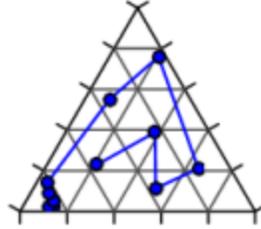


### Ternary Plots

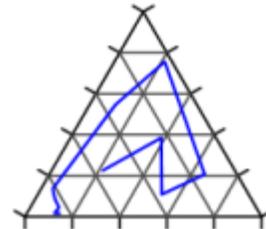
Ternary plots include ternary scatter, line/scatter, line, class, and bubble plots. The Ternary group also includes piper and piper class plots. All ternary plots display three variables on three axes, arranged in a triangle display. Classification information can be displayed on the plot when using 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.



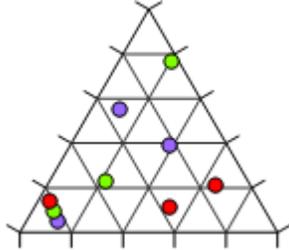
[Ternary Scatter Plot](#)



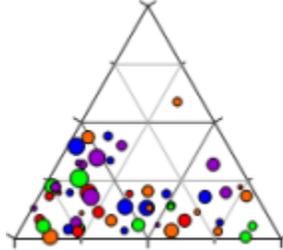
[Ternary Line/Scatter Plot](#)



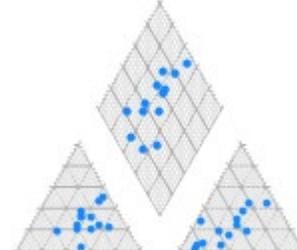
[Ternary Line Plot](#)



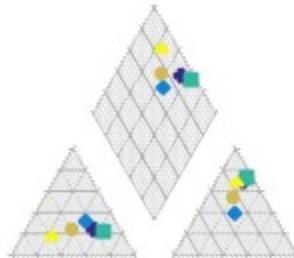
[Ternary Class Scatter Plot](#)



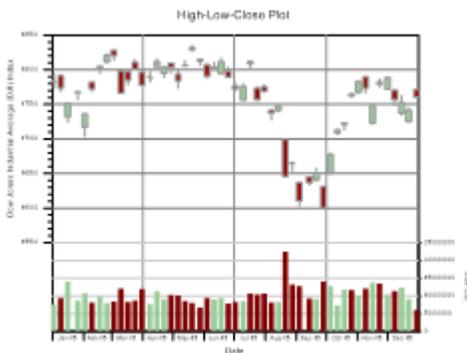
[Ternary Bubble Plot](#)



[Piper Plot](#)

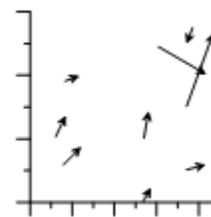
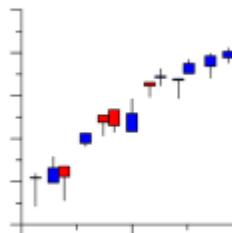
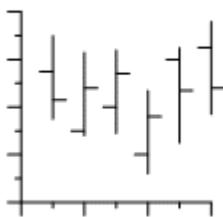


[Piper Class Scatter Plot](#)

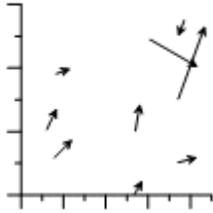


### Specialty Plots

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.

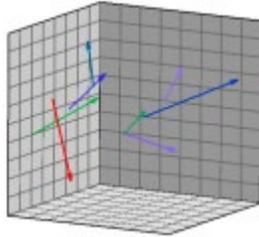


[High-Low-Close Plot](#)



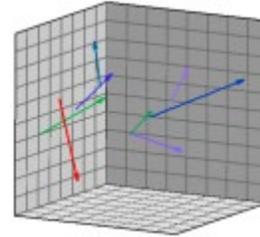
[2-Point Vector Plot](#)

[High-Low-Close Candlestick Plot](#)

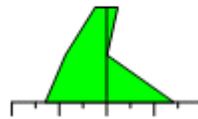


[XYZ 2-Point Vector Plot](#)

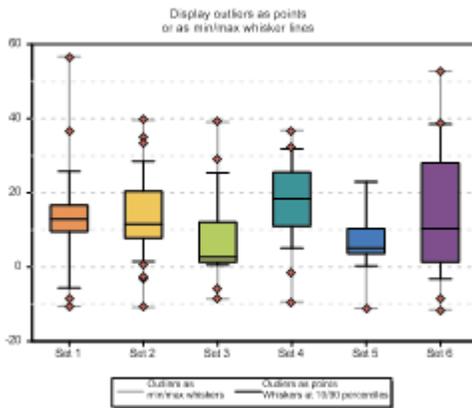
[1-Point Vector Plot](#)



[XYZ-dx,dy,dz Vector Plot](#)

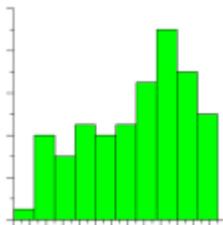


[Stiff Plot](#)

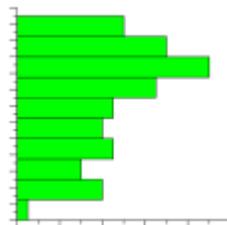


Statistical Plots

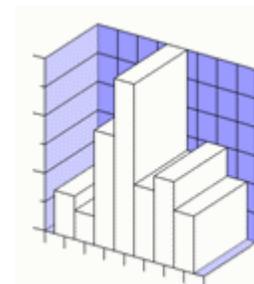
Statistical plots include 2D and 3D vertical and horizontal histograms, box-whisker plots, 2D and 3D pie charts, Q-Q plots, and 2D and 3D doughnut plots. Histograms read raw data and count the number of instances in each bin and then display the bin frequency as a bar. Pie charts display data as percentages 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.



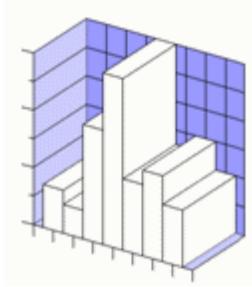
[Vertical Histogram](#)



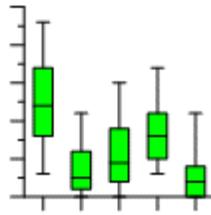
[Horizontal Histogram](#)



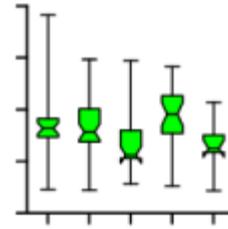
[3D Vertical Histogram](#)



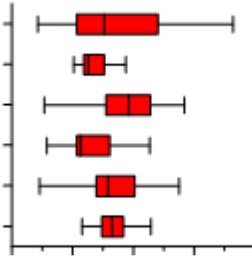
[3D Horizontal Histogram](#)



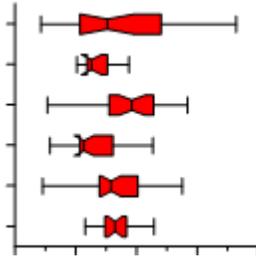
[Vertical Box Plot](#)



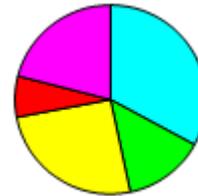
[Notched Vertical Box Plot](#)



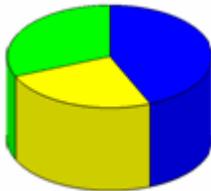
[Horizontal Box Plot](#)



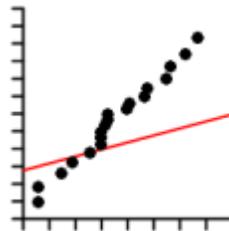
[Notched Horizontal Box Plot](#)



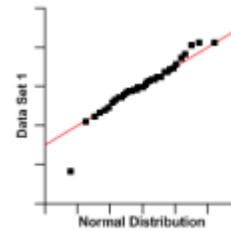
[Pie Chart](#)



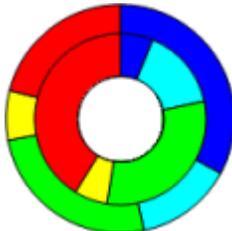
[3D Pie Chart](#)



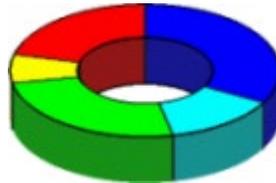
[Q-Q Plot](#)



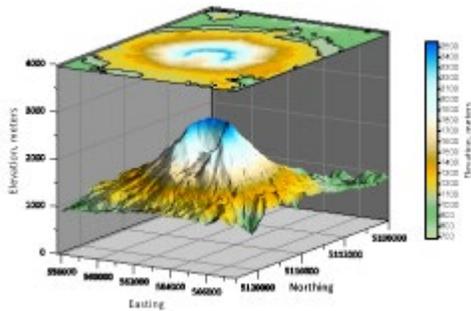
[Normal Q-Q Plot](#)



[Doughnut Plot](#)

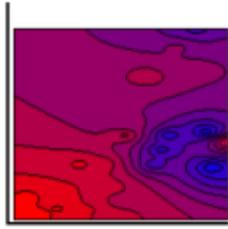


[3D Doughnut Plot](#)

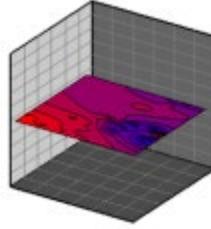


### Contour Surface Maps

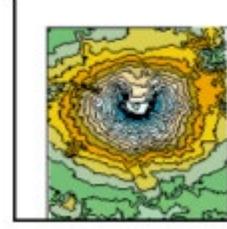
Contour maps include contour data maps, grid maps, and function maps. Contour maps are 2D representations of three variables. The contour line defines the equal Z values across the map. Contour maps can be displayed with an XY or XZ orientation. Surface Maps include surface data maps, grid maps, and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



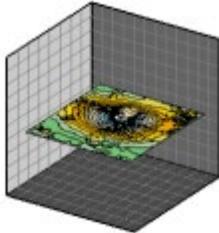
[XY Contour Data Map](#)



[XZ Contour Data Map](#)



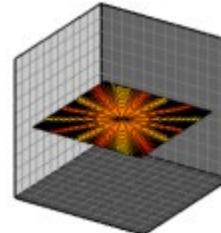
[XY Contour Grid Map](#)



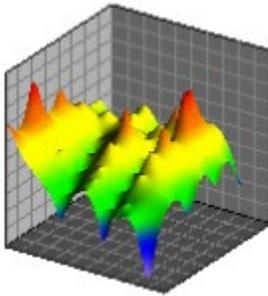
[XZ Contour Grid Map](#)



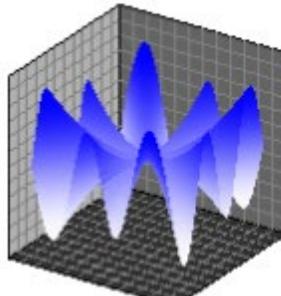
[XY Contour Function Map](#)



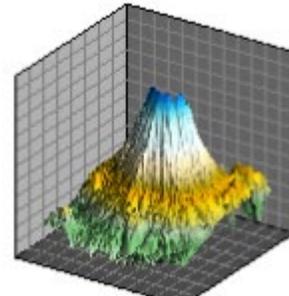
[XZ Contour Function Map](#)



[Surface Data Map](#)



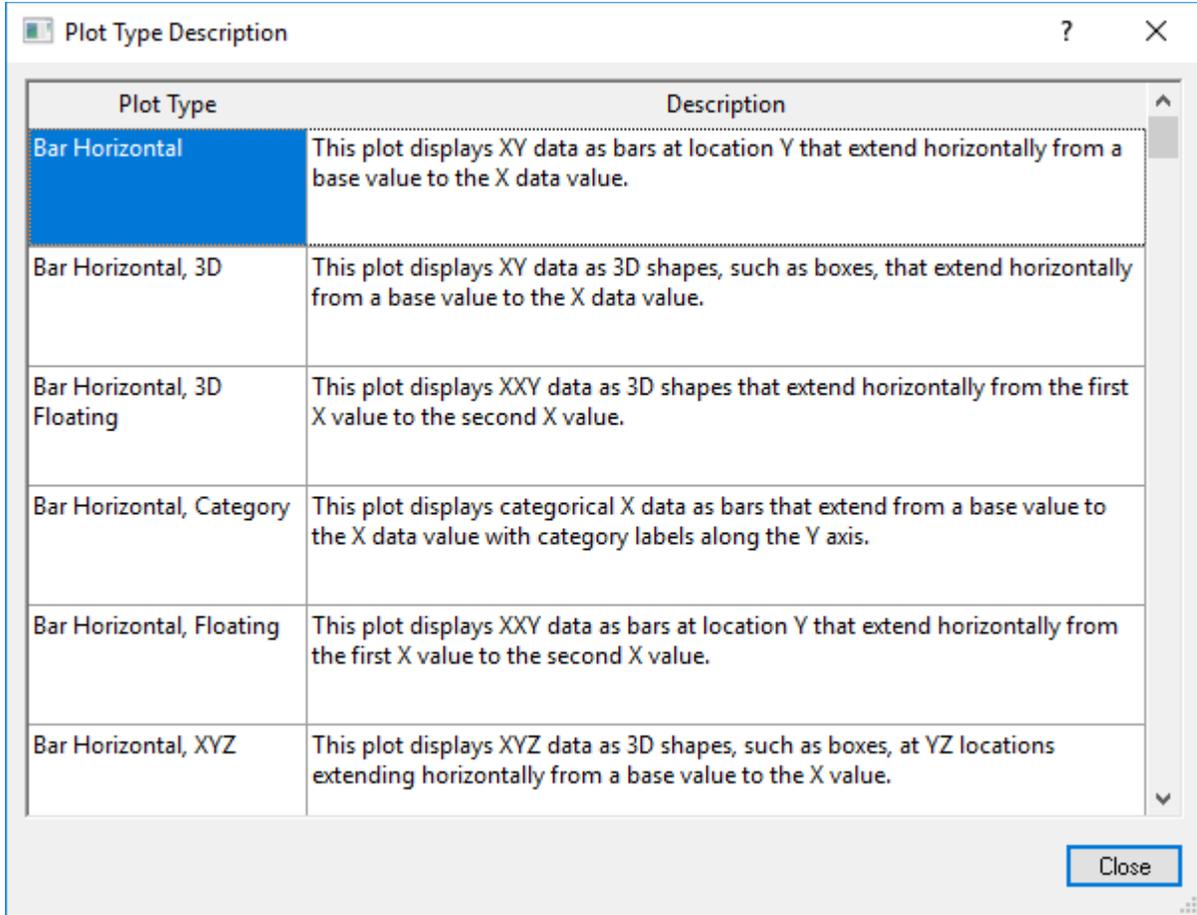
[Surface Function Map](#)



[Surface Grid Map](#)

## Plot Type Descriptions

The **Plot Type Description** dialog is opened by clicking *Help* in the [Graph Wizard - Select Plot Type](#) dialog. The **Plot Type Description** dialog displays a table of all the available plot types with a short description of the data required to create the plot and of the plot appearance. The **Plot Type Description** dialog can be used to determine which plot type will best represent your data. The *Plot Type* column indicates the plot type name in the **Graph Wizard**, and the *Description* column includes the description text that is displayed when the plot is selected.



Quickly browse the appearance and data requirement descriptions for all **Grapher** plot types in the **Plot Type Description** dialog.

The following tables present the same information, but present the plots in various groups to help you determine the best plot type for your data:

### XY Plots

The most common and flexible type of plot, these two-variable plots can be used to present correlation, display change over time, or analyze relationships between variables. Some line/scatter type plots include a third variable for proportional sizing or classification, and some bar plots include a third variable to indicate the bar start and end. The High-Low-Close plot is typically used for stock data and displays multiple Y values at each X.

Plot Type	Description
Bar Horizontal	This plot displays XY data as bars at location Y that extend horizontally from a base value to the X data value.
Bar Horizontal, 3D	This plot displays XY data as 3D shapes, such as boxes, that extend horizontally from a base value to the X data value.

Bar Horizontal, 3D Floating	This plot displays $XXY$ data as 3D shapes that extend horizontally from the first $X$ value to the second $X$ value.
Bar Horizontal, Floating	This plot displays $XXY$ data as bars at location $Y$ that extend horizontally from the first $X$ value to the second $X$ value.
Bar Vertical	This plot displays $XY$ data as bars at location $X$ that extend vertically from a base value to the $Y$ data value.
Bar Vertical, 3D	This plot displays $XY$ data as 3D shapes, such as boxes, that extend vertically from a base value to the $Y$ data value.
Bar Vertical, 3D Floating	This plot displays $XY$ data as 3D shapes that extend vertically from the first $Y$ value to the second $Y$ value.
Bar Vertical, Floating	This plot displays $XY$ data as bars at location $Z$ that extend vertically from the first $Y$ value to the second $Y$ value.
Bubble	This plot displays $XYZ$ data as bubbles, where $XY$ values specify the bubble center and $Z$ controls the bubble size.
Class Scatter	This plot displays $XYZ$ data as points, where $XY$ values specify point locations and points are classified by $Z$ value.
High-Low-Close	This plot displays a range of $Y$ values at each $X$ value as lines. It is typically used to display Open, High, Low, and Close stock prices.
High-Low-Close Candlestick	This plot displays a range of $Y$ values at each $X$ value as candlesticks, typically used to display Open, High, Low, and Close stock prices.
Line	This plot displays $XY$ data connected by a line.
Line/Scatter	This plot displays $XY$ data as points with a connecting line.
Polar Bar	This plot displays Angle and Radius data as bars that extend from a base value to the radius value in polar coordinates.
Polar Class Scatter	This plot displays Angle, Radius, and $Z$ data as a scatterplot in polar coordinates where points are classified by $Z$ value.
Polar Line	This plot displays Angle and Radius data connected by a line in polar coordinates.
Polar Line/Scatter	This plot displays Angle and Radius data as points with a connecting line in polar coordinates.
Polar Scatter	This plot displays Angle and Radius data as points in polar coordinates.
Ribbon	This plot displays $XY$ data as a line plot with depth to appear as a three-dimensional ribbon.
Scatter	This plot displays $XY$ data as points.
Step	This plot displays $XY$ data points connected by a line where the connecting line is drawn parallel to the axes.

Step, 3D	This plot displays XY data as a step plot with depth to appear as a 3D ribbon.
Wall, 3D	This plot displays XY data as a line plot with depth to appear as a 3D wall.

XYZ Plots

These plots are similar to XY plots, but include a third variable and dimension. They also may include a fourth variable for proportional sizing or classification.

Plot Type	Description
Bar Horizontal, XYZ	This plot displays XYZ data as 3D shapes, such as boxes, at YZ locations extending horizontally from a base value to the X value.
Bar Horizontal, XYZ Floating	This plot displays XYZ data as 3D shapes, such as boxes, at YZ locations extending horizontally from the first X value to the second X value.
Bar Vertical, XYZ	This plot displays XYZ data as 3D shapes, such as boxes, at XZ locations extending vertically from a base value to the Y value.
Bar Vertical, XYZ Floating	This plot displays XYZ data as 3D shapes, such as boxes, at XZ locations extending vertically from the first Y value to the second Y value.
Bubble, XYZ	This plot displays XYZ data as 3D bubbles where XYZ describes bubble position, and the bubbles are scaled by C value.
Class Scatter, XYZ	This plot displays XYZ data as points where XYZ describes point location, and the points are classified by C value.
Line/Scatter, XYZ	This plot displays XYZ data as a line, line/scatter, or scatter plot in three-dimensional space.

Categorical Plots

Categorical plots display quantities (bar) or proportions (pie/doughnut) of a data value for various categories. The radar plot displays multivariate qualitative data.

Plot Type	Description
Bar Horizontal, Category	This plot displays categorical X data as bars that extend from a base value to the X data value with category labels along the Y axis.
Bar Vertical, Category	This plot displays categorical Y data as bars that extend from a base value to the Y data value with category labels along the X axis.
Doughnut	This plot displays data as proportional slices of circle with a hole in the center.

Doughnut, 3D	This plot displays data as proportional slices of a cylinder with a hole in the center.
Pie	This plot displays data as proportional slices of a circle.
Pie, 3D	This plot displays data as proportional slices of a cylinder.
Radar	This plot, also called a spider plot, displays multivariate quantitative data as a polygon with an equi-angular axis for each variable.

### Statistical Plots

Statistical plots display the distribution of a variable. Histograms present the distribution by binning the data values and displaying the bin quantities. Box-whisker plots graphically display statistical information about one or more distributions. Q-Q plots compare distributions to one another or to the normal distribution. The Polar Wind Chart displays the distributions of two separate variables in a single chart.

Plot Type	Description
Box Horizontal	This plot displays the distribution of one or more datasets as horizontal boxes with whiskers.
Box Horizontal, Notched	This plot displays the distribution of one or more data sets as notched horizontal boxes with whiskers.
Box Vertical	This plot displays the distribution of one or more datasets as vertical boxes with whiskers.
Box Vertical, Notched	This plot displays the distribution of one or more data sets as notched vertical boxes with whiskers.
Histogram Horizontal	This plot displays the distribution of a dataset as bars where frequency is on the X axis and bin values are on the Y axis.
Histogram Horizontal, 3D	This plot displays the distribution of a dataset as 3D shapes where frequency is on the X axis and bin values are on the Y axis.
Histogram Vertical	This plot displays the distribution of a dataset as bars where frequency is on the Y axis and bin values are on the X axis.
Histogram Vertical, 3D	This plot displays the distribution of a dataset as 3D shapes where frequency is on the Y axis and bin values are on the X axis.
Polar Rose	This plot displays the distribution of a dataset as bars where frequency is on the radius axis and bins are on the angular axis.
Polar Wind	This plot displays the distribution of Direction data as bars where frequency is on the radius axis and bars are grouped by Speed.
Q-Q	This plot displays the quantiles of two probability distributions against one another as points with a $y=x$ line.

Q-Q, Normal	This plot displays the quantiles of a probability distribution against the normal distribution as points with a $y=x$ line.
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### Composition Plots

The stiff, ternary, and piper diagrams typically describe the chemical composition of systems. In some ternary and piper diagrams, a data column can be used for proportional scaling or classification.

Plot Type	Description
Piper	This plot displays ionic composition of a water sample or samples in cation and anion ternary plots and a diamond plot.
Piper Class Scatter	This plot displays ionic composition of a water sample or samples in cation and anion ternary plots and a diamond plot with classified symbols.
Stiff	This plot displays cation and anion concentrations as points with a connecting line where concentration is on the horizontal axis.
Ternary Bubble	This plot displays XYZC data as bubbles where XYZ are proportions in a three-component system and the bubbles are scaled by C value.
Ternary Class Scatter	This plot displays XYZC data as points where XYZ are proportions in a three-component system and the point is classified by C value.
Ternary Line	This plot displays XYZ data as a line where XYZ are proportions in a three-component system.
Ternary Line/Scatter	This plot displays XYZ data as points with a connecting line where XYZ are proportions in a three-component system.
Ternary Scatter	This plot displays XYZ data as points where XYZ are proportions in a three-component system.

### Function Plots (no data)

Function plots require no data and create a plot from a mathematical function.

Plot Type	Description
Function Parametric	This plot displays mathematical functions as a line where the values of X and Y are a function of the variable T.
Function Parametric, 3D	This plot displays a mathematical function as a 3D ribbon where the values of X and Y are a function of the variable T.
Function $X=F(Y)$	This plot displays a mathematical function as a line where the value of X is a function of the variable Y.
Function $X=F(Y)$ , 3D	This plot displays a mathematical function as a 3D ribbon where the value of X is a function of the variable Y.

Function $Y=F(X)$	This plot displays a mathematical function as a line where the value of Y is a function of the variable X.
Function $Y=F(X)$ , 3D	This plot displays a mathematical function as a 3D ribbon where the value of Y is a function of the variable X.
Polar Function	This plot displays a mathematical function as a line where the value of R (radius) is a function of the variable A (angle).
Polar Function Parametric	This plot displays a mathematical function as a line where the values of R (radius) and A (angle) are a function of the variable T.

### Vector Plots

Vector plots show magnitudes at a position or movement from one position to another. Grapher includes 2D and 3D vector plots and includes both Cartesian and polar coordinates.

Plot Type	Description
Polar Vector 1-Point	This plot displays polar coordinate data as vectors defined by vector origin Angle and Radius and vector Direction and Magnitude.
Polar Vector 2-Point	This plot displays polar coordinate data as vectors defined by vector origin Angle and Radius and vector end Angle and Radius.
Vector 1-Point	This plot displays XYDM data as vectors where XY describes vector origin and Direction and Magnitude describe the vector.
Vector 2-Point	This plot displays XYXY data as vectors where the first XY pair describes the vector origin and the second XY pair describes the vector end.
Vector XYZ-DX,DY,DZ	This plot displays XYZdXdYdZ data as vectors where vector origins are described by XYZ, and vectors are described by dXdYdZ.
Vector XYZ 2-Point	This plot displays XYZXYZ data as vectors where vector origins are the first XYZ values, and vector ends are the second XYZ values.

### Maps

These plots present XYZ data or mathematical functions as maps or surfaces.

Plot Type	Description
Contour Data, XY	This plot displays XYZ data as an XY map with lines of constant Z.
Contour Data, XZ	This plot displays XYZ data as an XY map with lines of constant Z rotated onto the XZ plane.
Contour Function, XY	This plot displays a mathematical function as an XY map with lines of constant Z where Z is a function of the variables X and Y.

Contour Function, XZ	This plot displays a mathematical function as an XZ map with lines of constant Y, where Y is a function of variables X and Z.
Surface Data	This plot displays XYZ data as a 3D surface.
Surface Function	This plot displays a mathematical function as a 3D surface where Y is a function of the variables X and Z.

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](http://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 corrections 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](#).

If there is an available update to a new minor version (e.g. **Grapher 14.0** to **Grapher 14.1**), you can 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](http://www.goldensoftware.com/Grapher-Version-Info).

If there is an available update to a new major version (e.g. **Grapher 13** to **Grapher 14**) 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.

Technical support is available Monday through Friday 8:00 AM to 5:00 PM Mountain Time, excluding major United States holidays. We will respond to email and fax technical questions within one business day. 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**

## Grapher User's Guide

- 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 online help, the frequently asked questions, the knowledge base, or in the support forums, please do not hesitate to contact us:

Email: [GrapherSupport@GoldenSoftware.com](mailto:GrapherSupport@GoldenSoftware.com)

Web: [www.GoldenSoftware.com](http://www.GoldenSoftware.com)

Phone: 303-279-1021

Fax: 303-279-0909

Mail: Golden Software, LLC, 809 14<sup>th</sup> Street, Golden, Colorado, 80401-1866, USA



## Chapter 2 - Tutorial

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 14 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 Creating Data

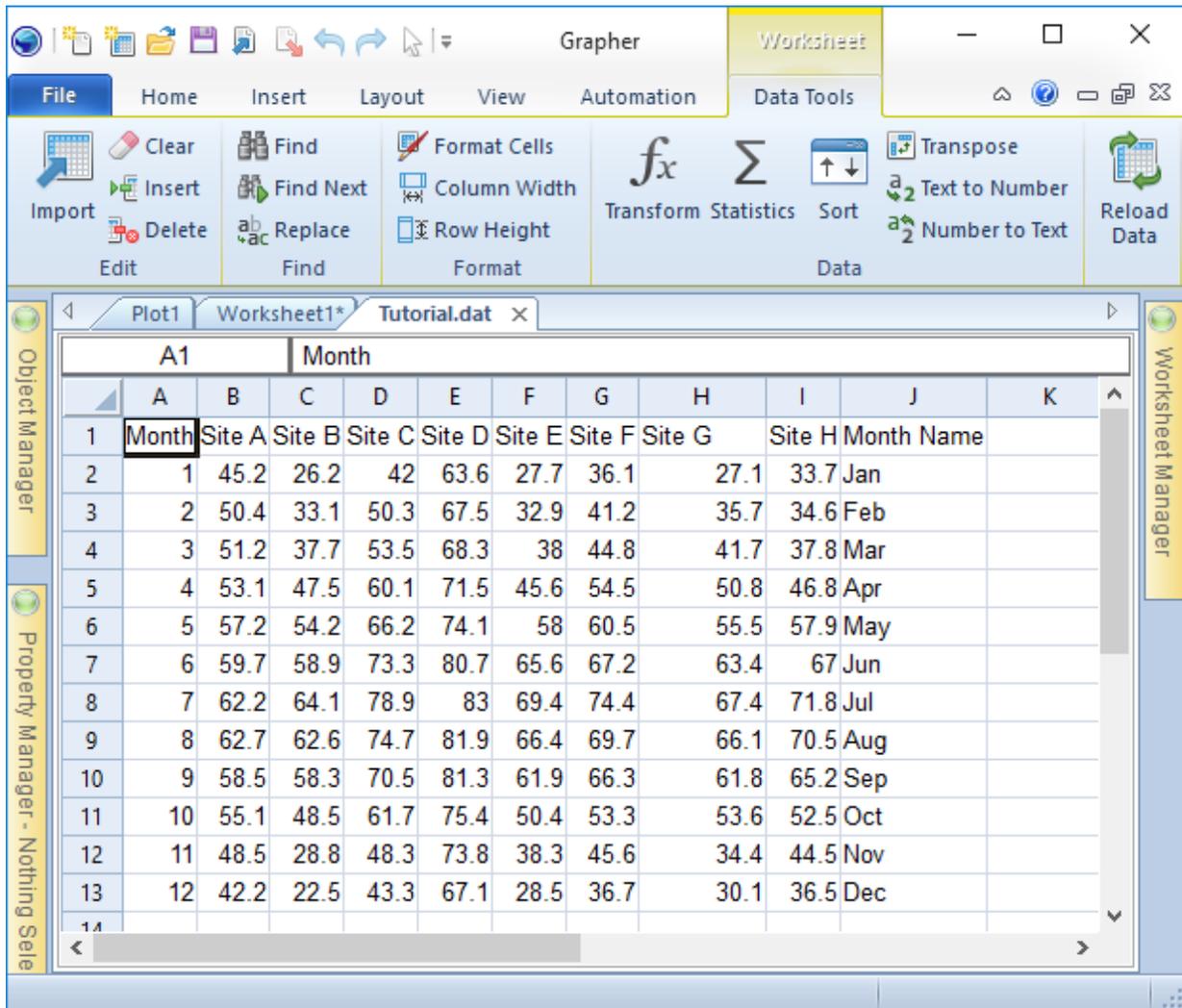
A data file is a file that contains columns or rows of data values. At minimum, two columns or rows are required to create most 2D graphs in **Grapher**. Data files can contain header information, labels, point identifiers, filter information, and data. It is often a good idea to examine the data file 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 14\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

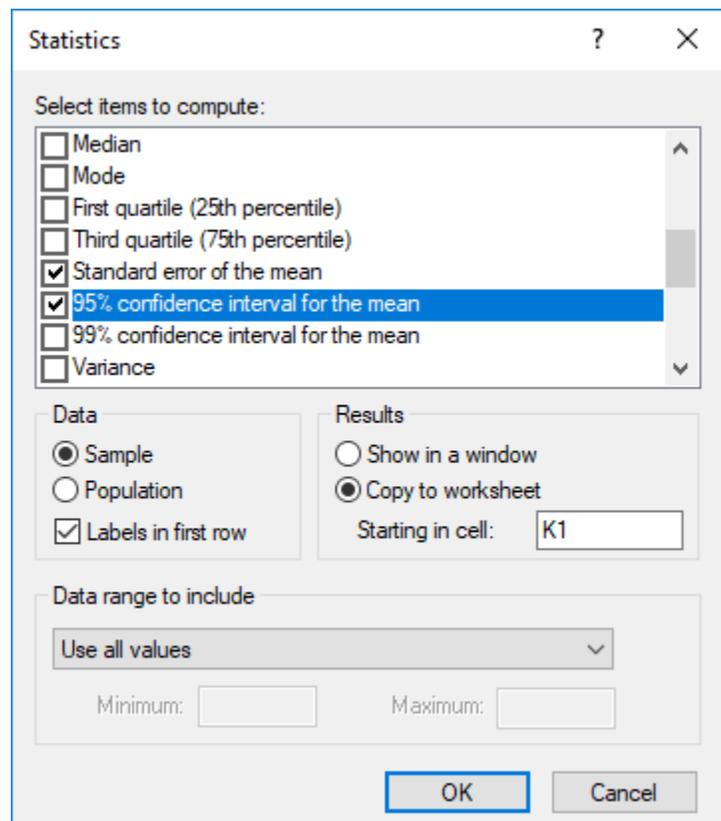
To edit any value, click in the cell to select it. Type information and the existing value is overwritten. Data can be [sorted](#), [transformed](#), or [transposed](#) in this window. You can also calculate [statistics](#) for the worksheet data in this window. New columns or rows can also be added. 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

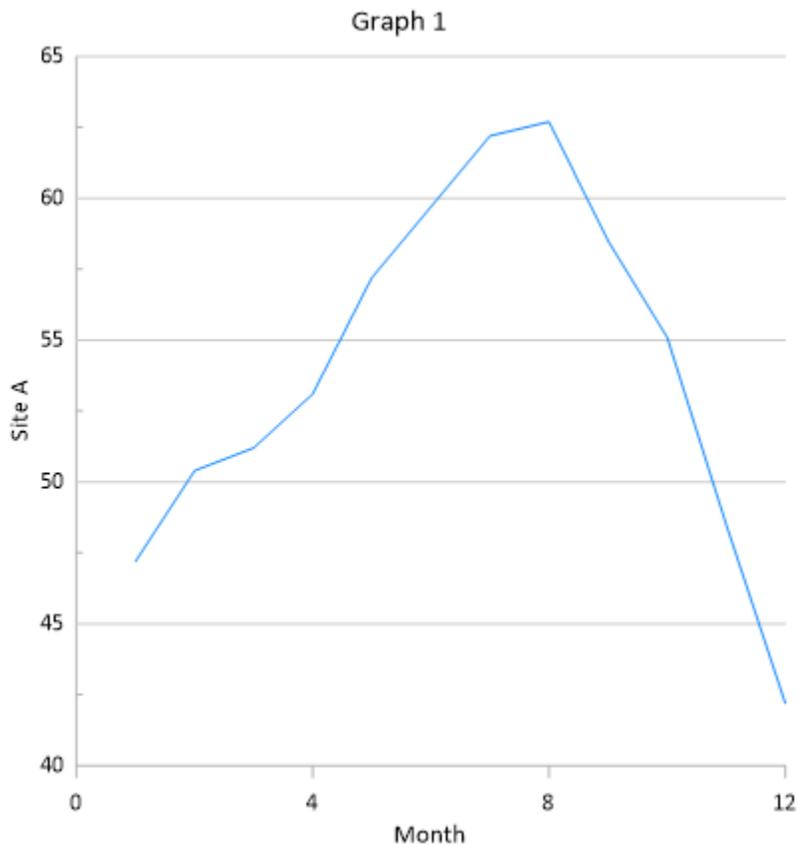
You can create graphs in several ways in **Grapher**. Graphs can be created with the [graph wizard](#), from the **Home | New Graph** commands, from the [worksheet](#), and from [templates](#). All of these methods are discussed in the [Creating Graphs](#) help topic. We will use the most common method 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.

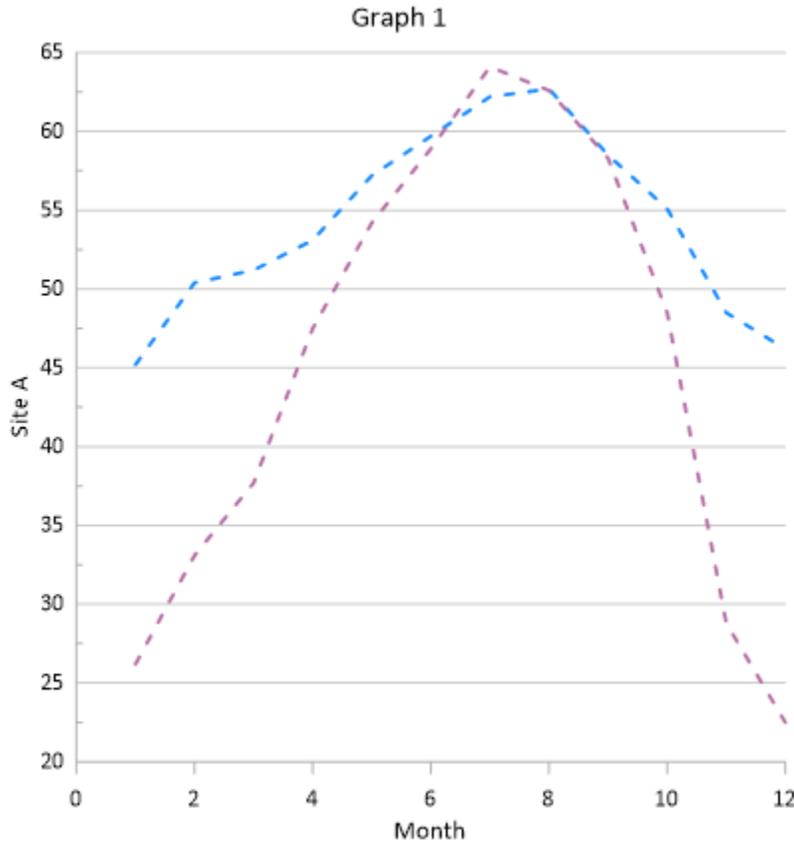
### Adding a New Plot

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.



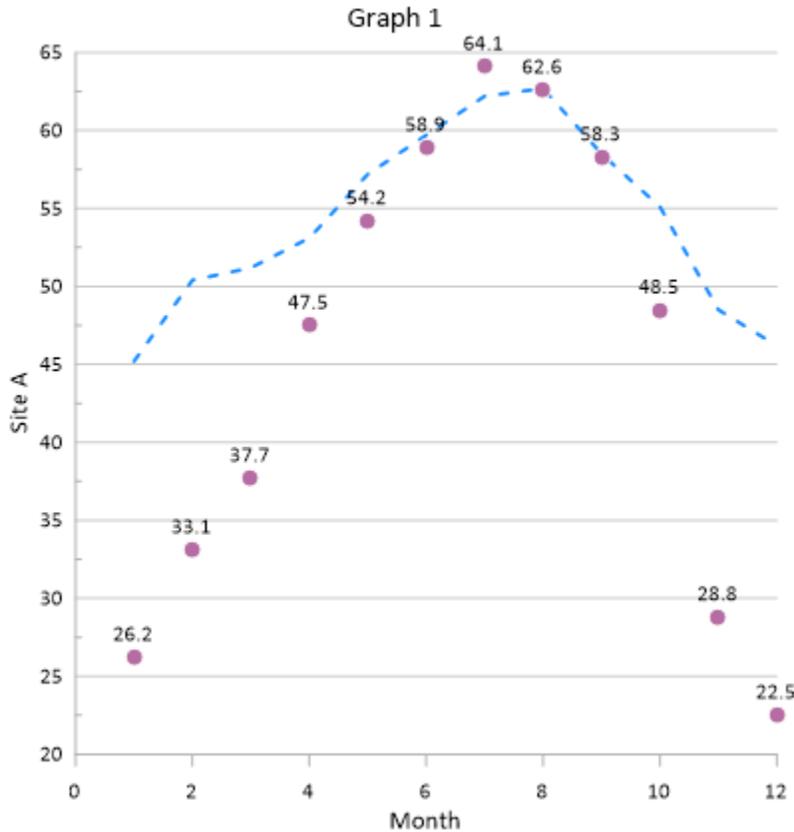
*The second line plot is added to the graph using the same axes and properties as the first plot.*

### 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 again to end moving labels mode.

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

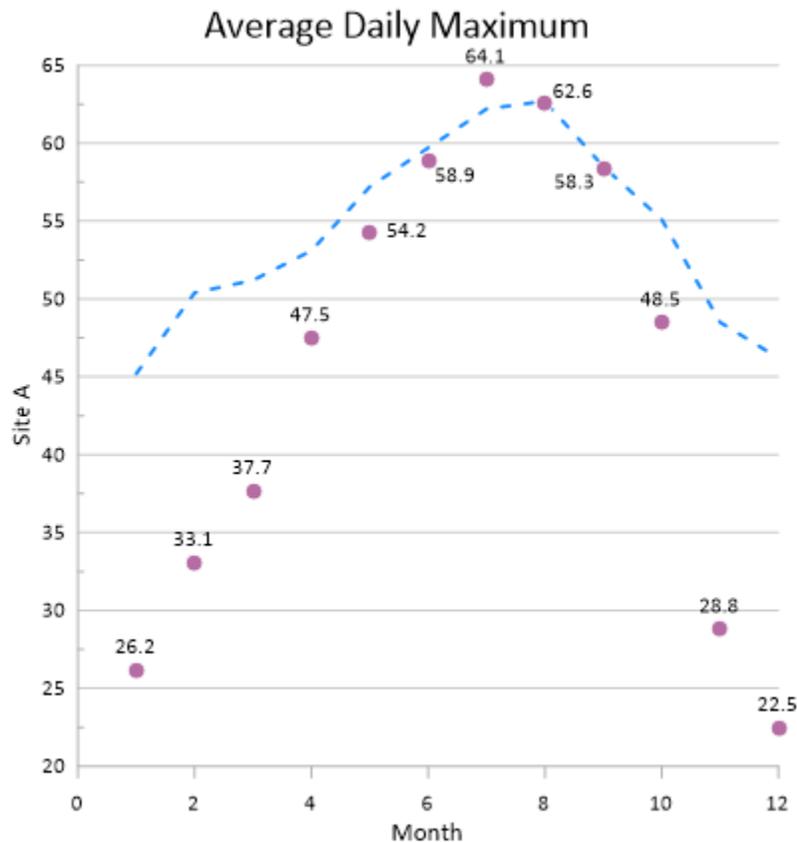
### Adding a Graph Title

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.



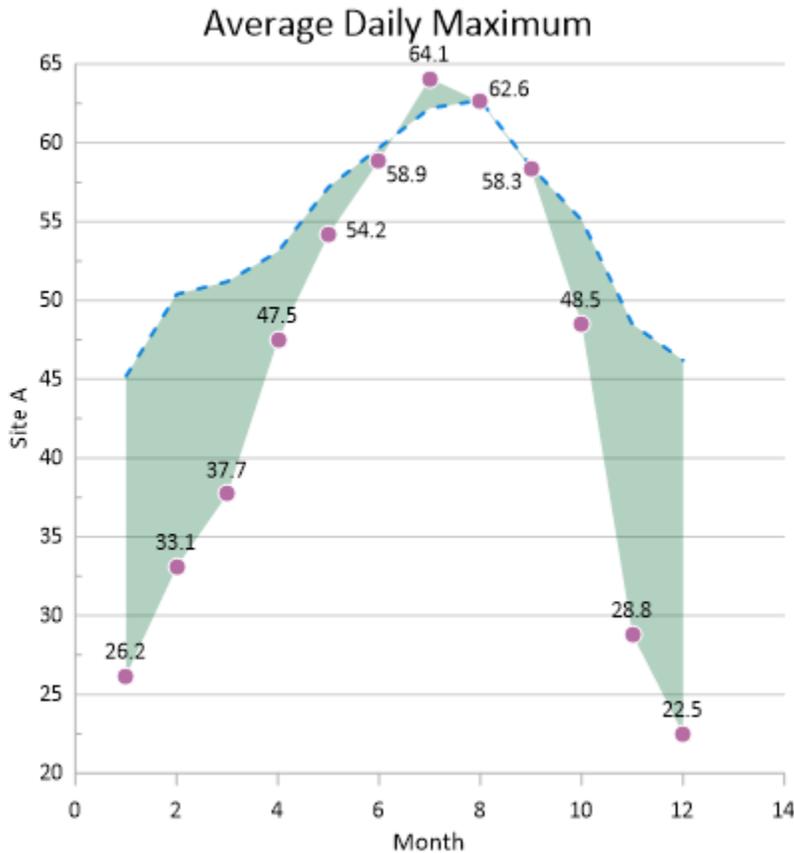
*Add a graph title to display additional information about the graph.*

### 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.



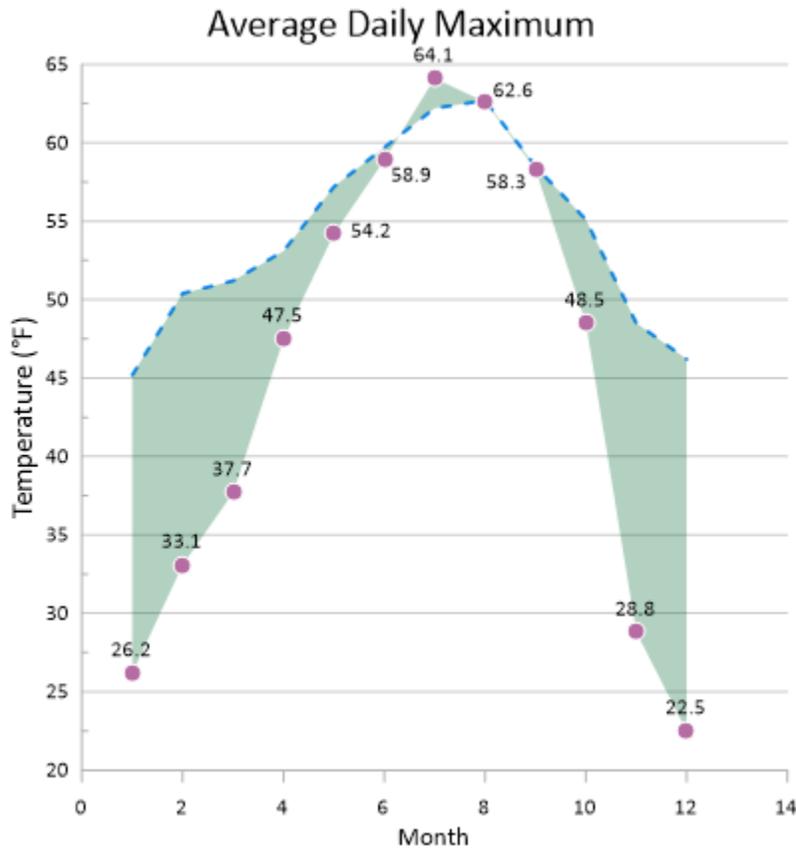
*The fill between plots highlights the difference in values.*

## 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  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**.*

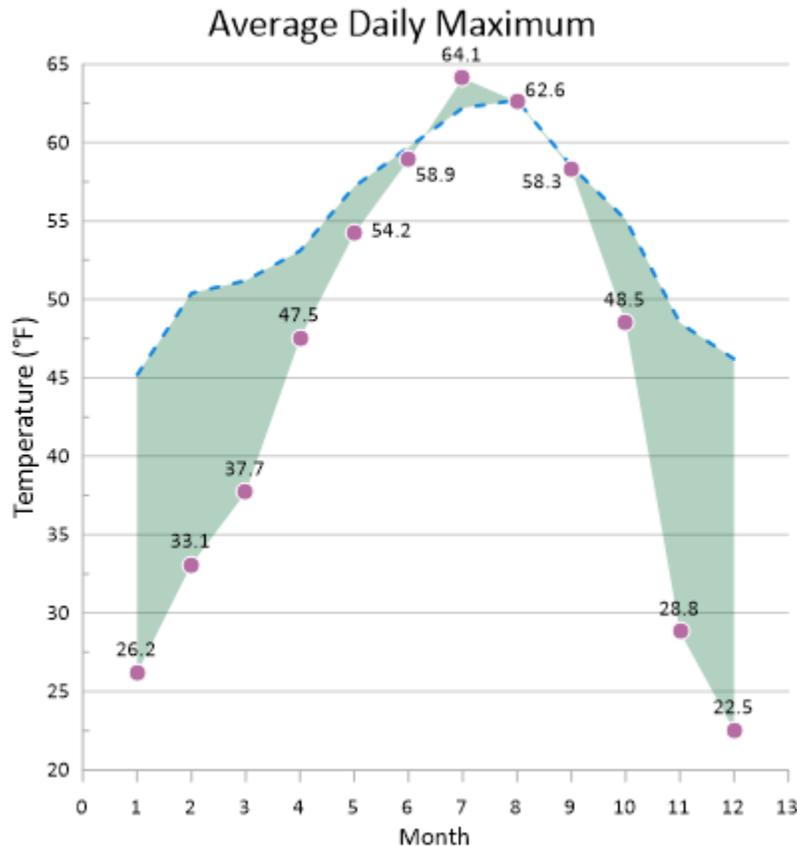
### Changing the Tick Mark Spacing

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.

- 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

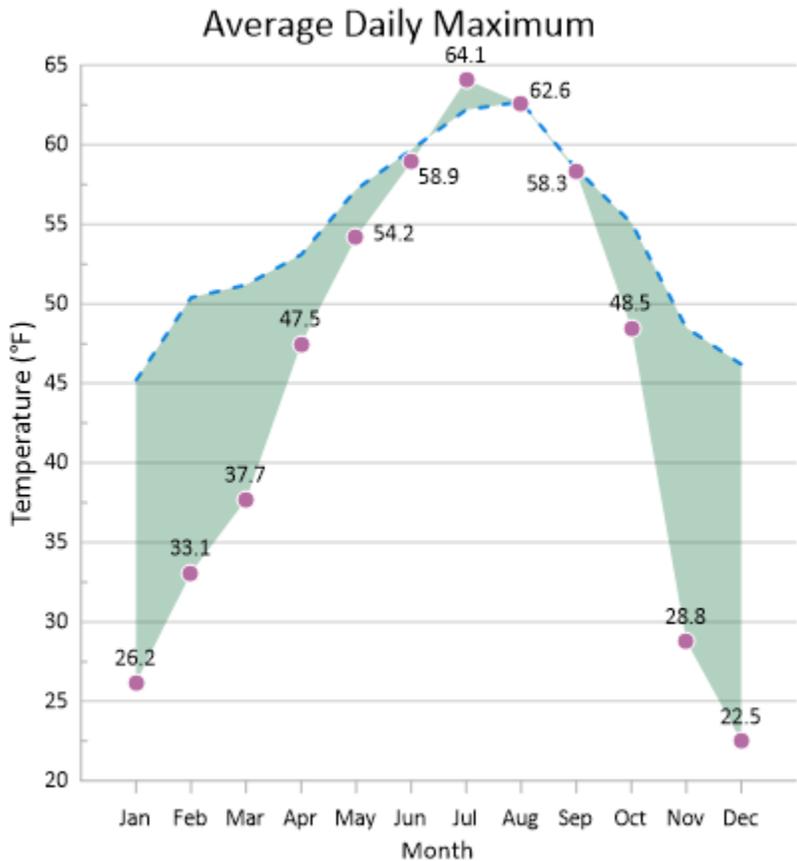
[Tick labels](#) can be displayed using different label sources including *Automatic*, [Date/Time](#), and *From worksheet*. Automatic labels are the default, however there may be situations where either using a number to represent date/time values or labels directly from a worksheet source may be useful. 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:

- Click on the *X Axis 1* in the [Object Manager](#) to select it.
- In the [Property Manager](#), click on the **Labels** tab to open the [tick label properties](#).
- 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.
- 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.

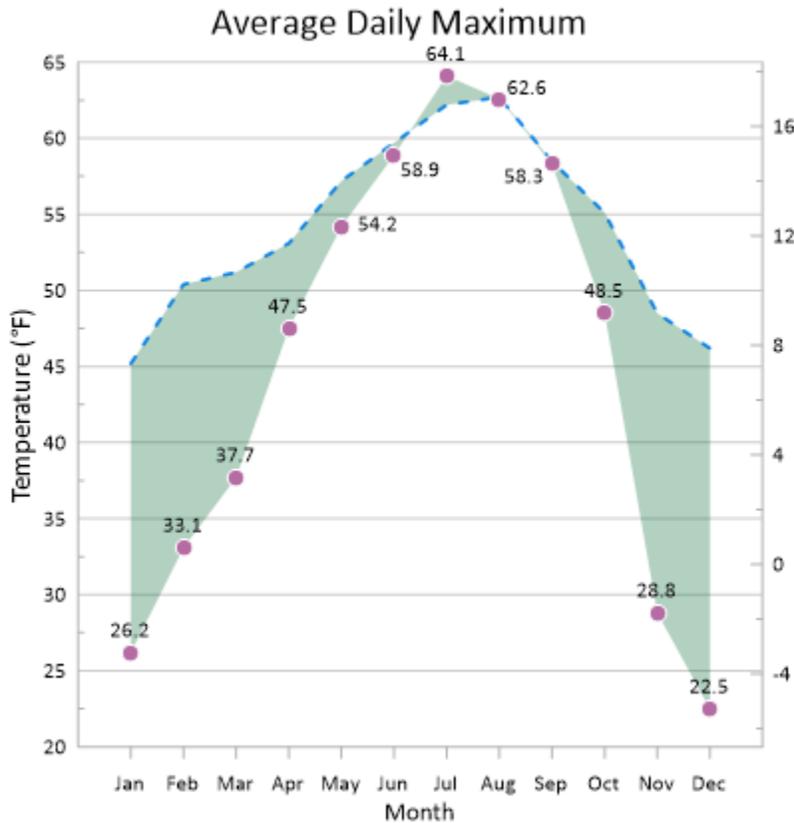
### Adding a Secondary Linked Axis

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 marks and 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* button next 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.

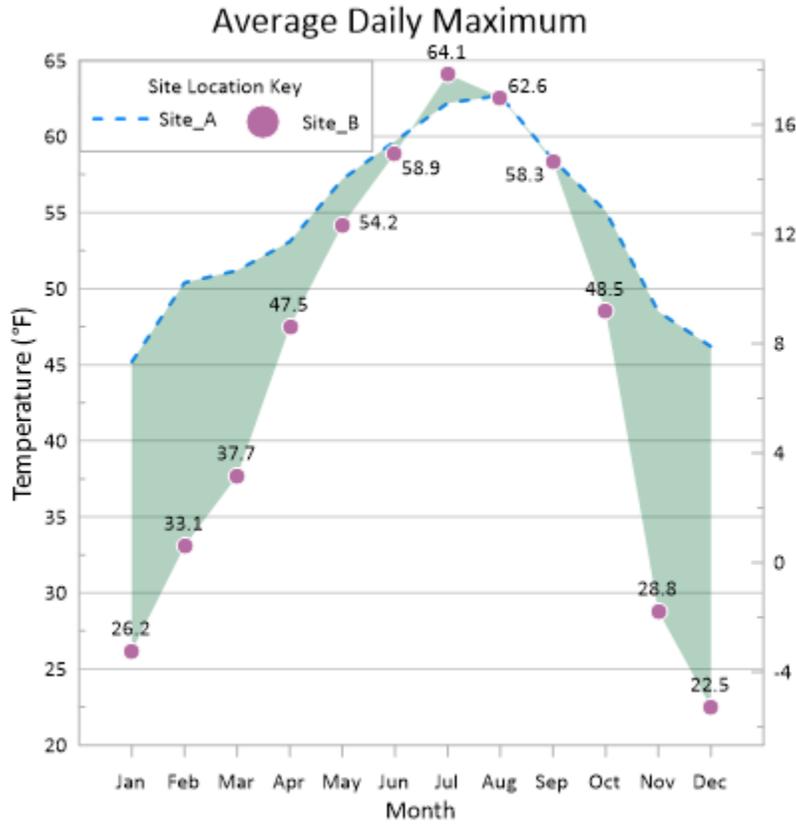
The symbol size for Site A in the legend is now 0.3 inches, i.e. slightly larger than the symbols in the plot. If the other plot also displayed symbols, checking the *Apply to all entries* option in the **Symbol Size** dialog would make all plots show the symbols at the specified size.

### 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.

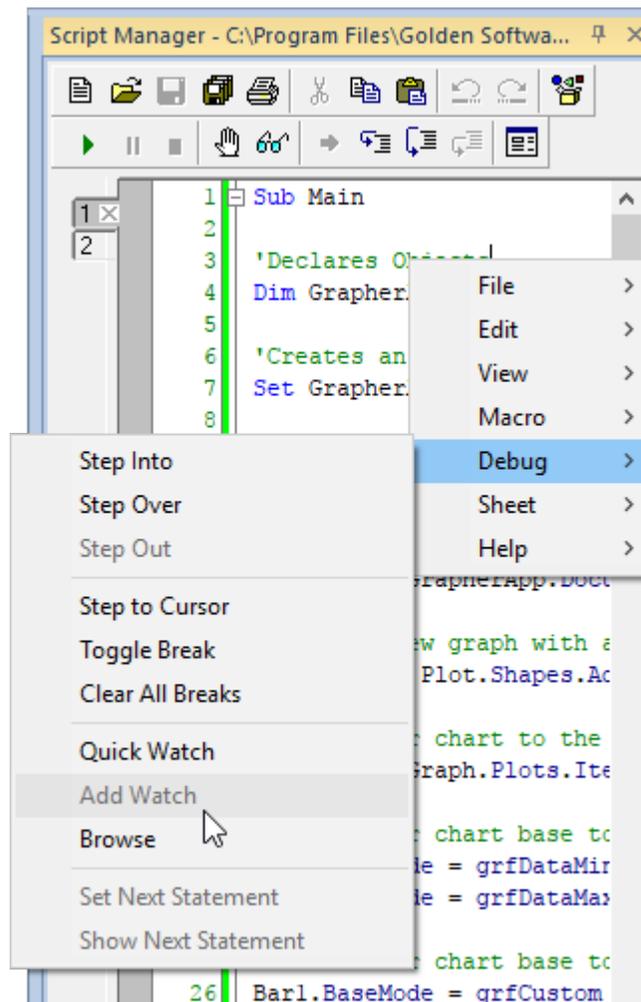
The graph in this example is fairly simple for time's sake, but keep in mind that complex graphs are very well suited to automation. We will record the process of creating a graph, changing some features of a graph, and adding a fit curve. The creation of this graph uses the features included in the

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.



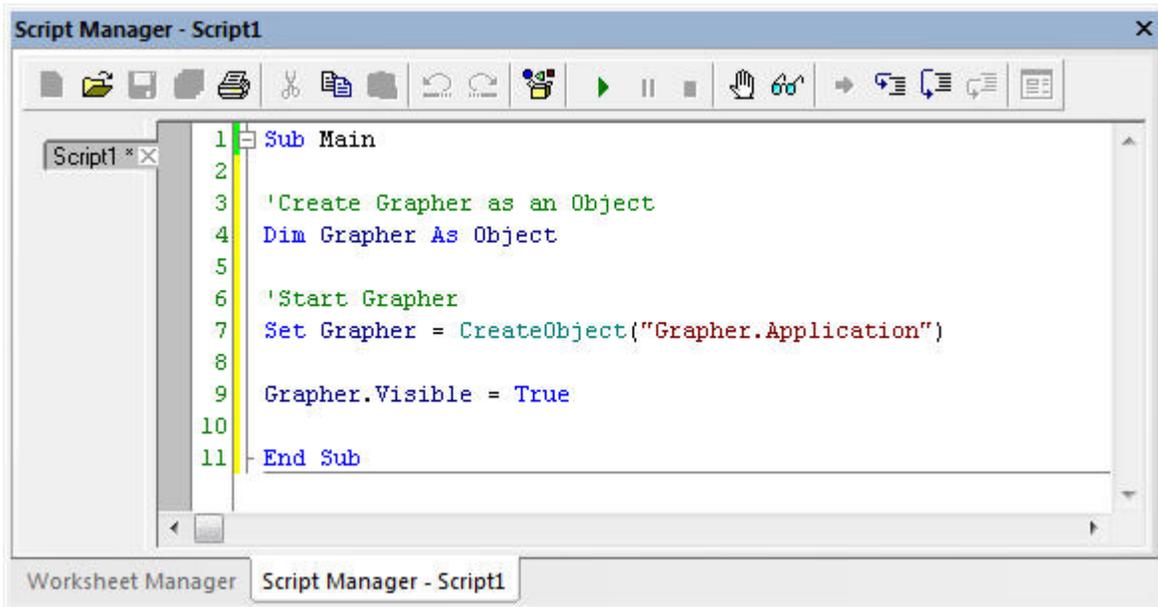
*Click the **Script Manager** tab to view, edit, and run scripts.*

### 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.



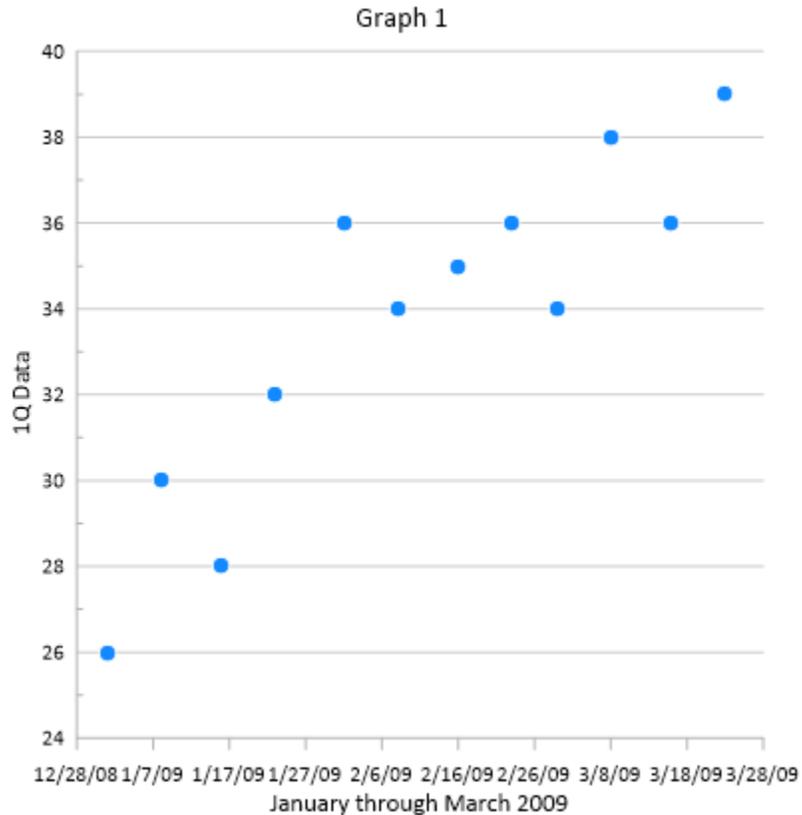
*Code is immediately added to the **Script Manager** when script recording begins. This information starts **Grapher** when the script is run later. The text in green with an apostrophe prefix are comments.*

## 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 14\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.



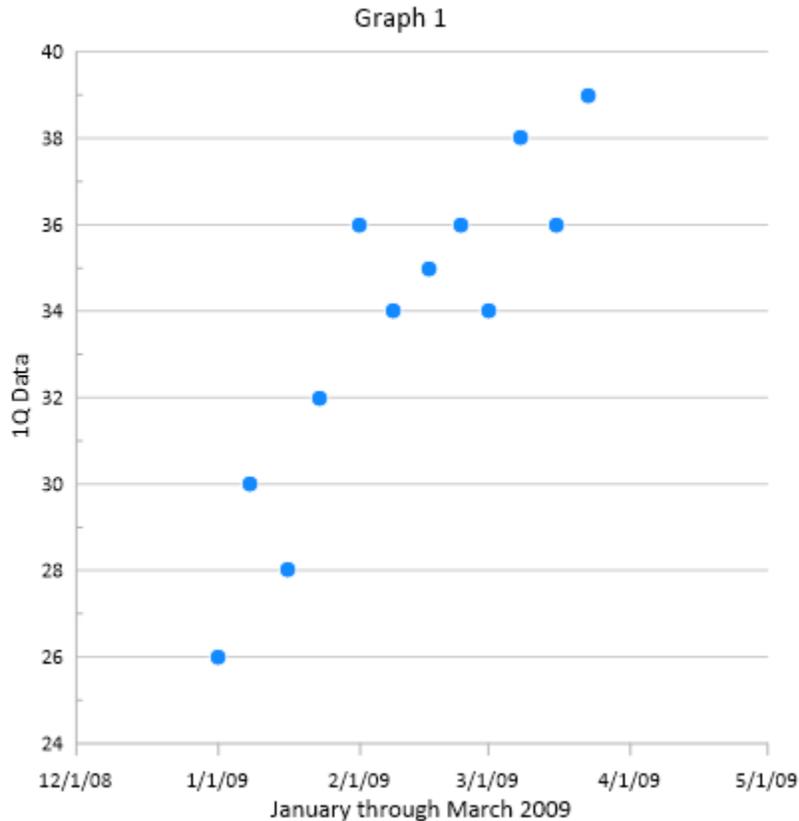
*The graph is created with the default properties.*

### 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.



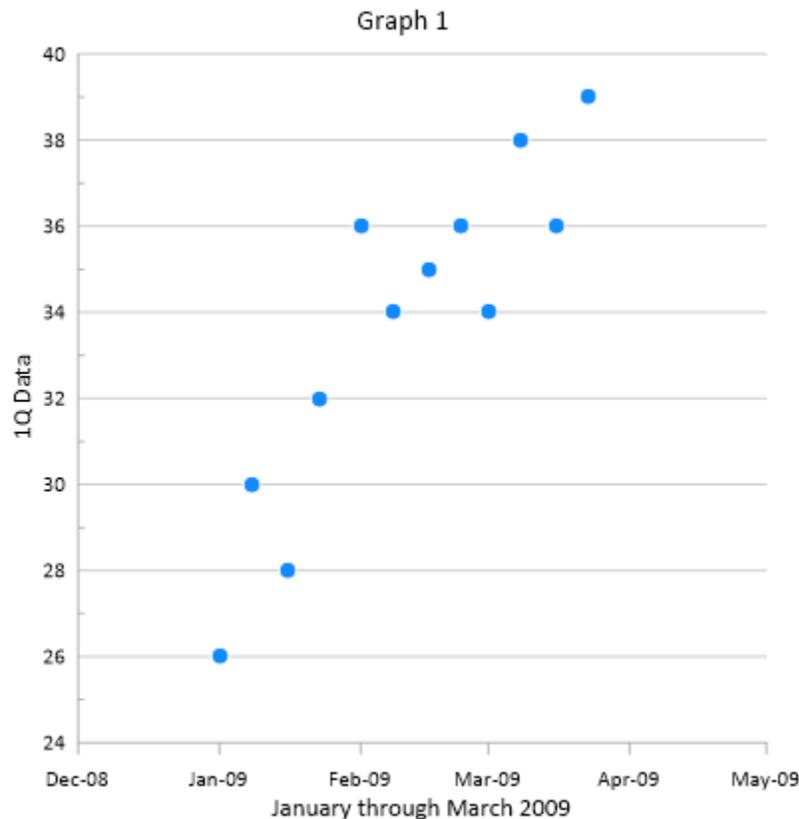
*The X Axis tick mark spacing can be based on date/time units.*

### 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.



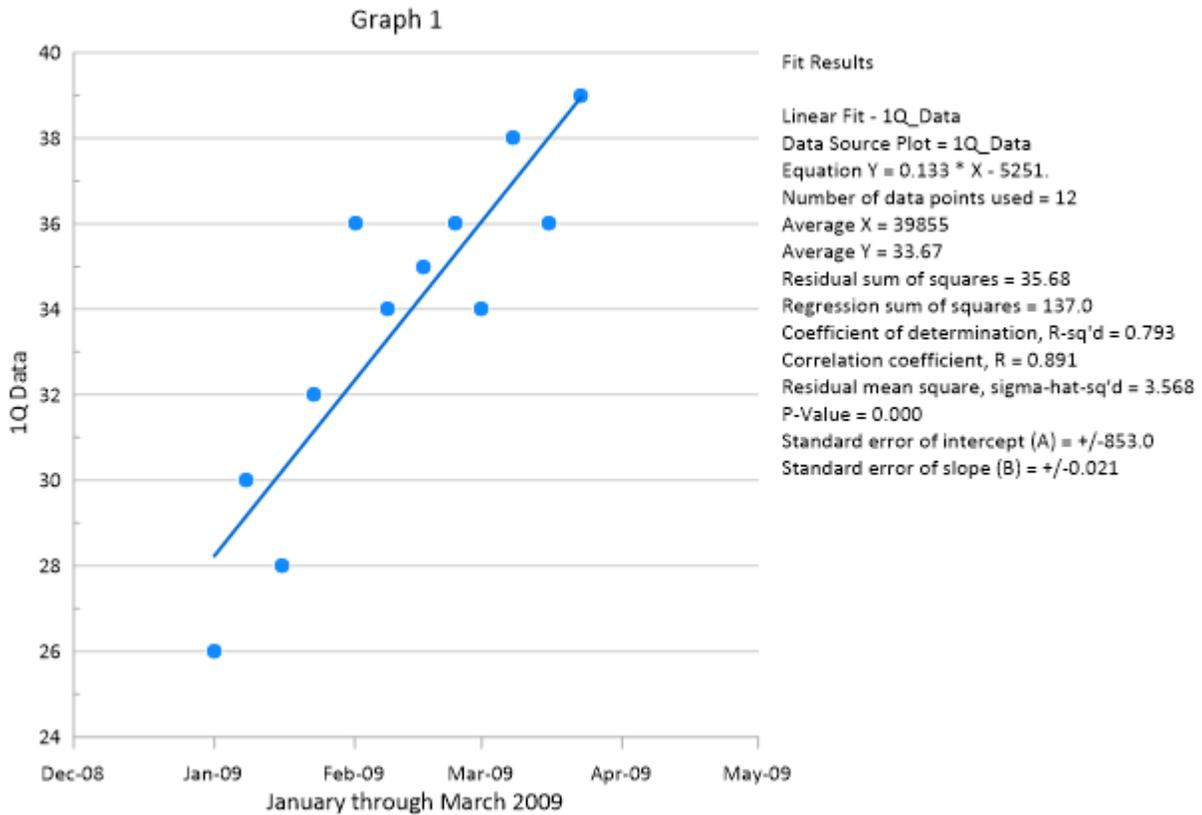
*The X Axis date/time labels can be formatted with a predefined or custom format.*

### 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 the **Plot** tab in the **Property Manager** to display the fit curve properties.
4. Set the *Significant digits* property to 4.
5. Click *Insert* next to the *Insert into plot document* field. The cursor changes to a crosshair to indicate draw mode.
6. 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!

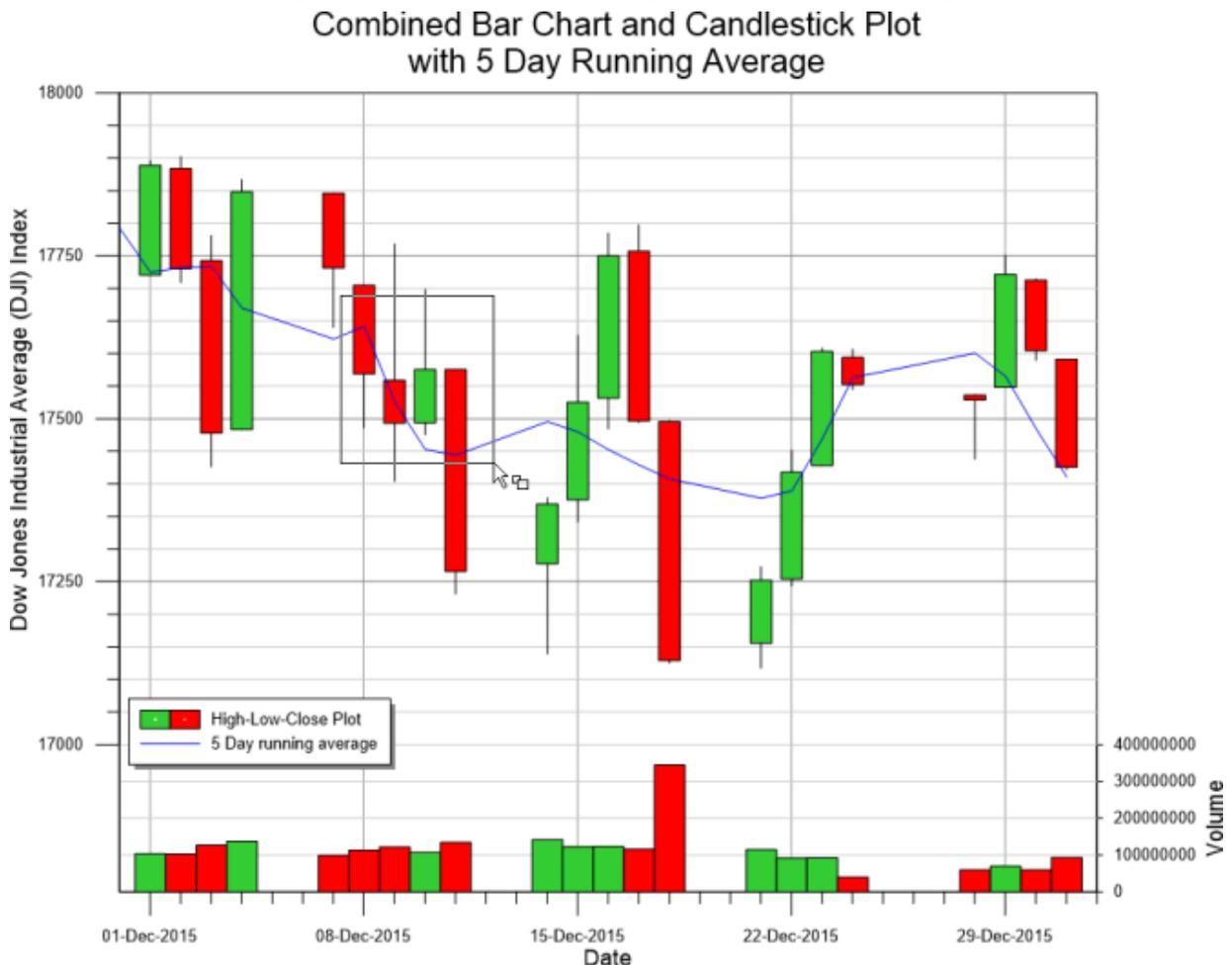
## Advanced Lessons

### Advanced Tutorial - Using the Magnifier

The [Graph Tools | Add to Graph | Magnifier](#) allows you to magnify a portion of a 2D graph.

To open a sample file and add a magnifier to a 2D graph:

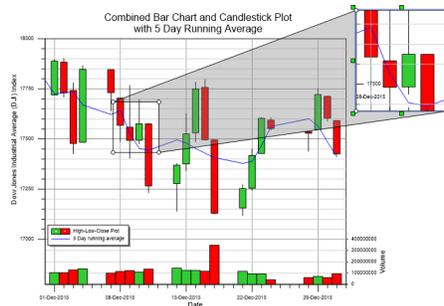
1. Click the **File | Open** command.
2. Navigate to C:\Program Files\Golden Software\Grapher 14\Samples, select *candlestick plot.grf* and click *Open*.
3. Select *Graph 2* in the **Object Manager**.
4. Click the [Graph Tools | Add to Graph | Magnifier](#) command or right-click on *Graph 2* and select **Add Magnifier**.
5. The cursor changes to . Left-click and drag to define an area to magnify.



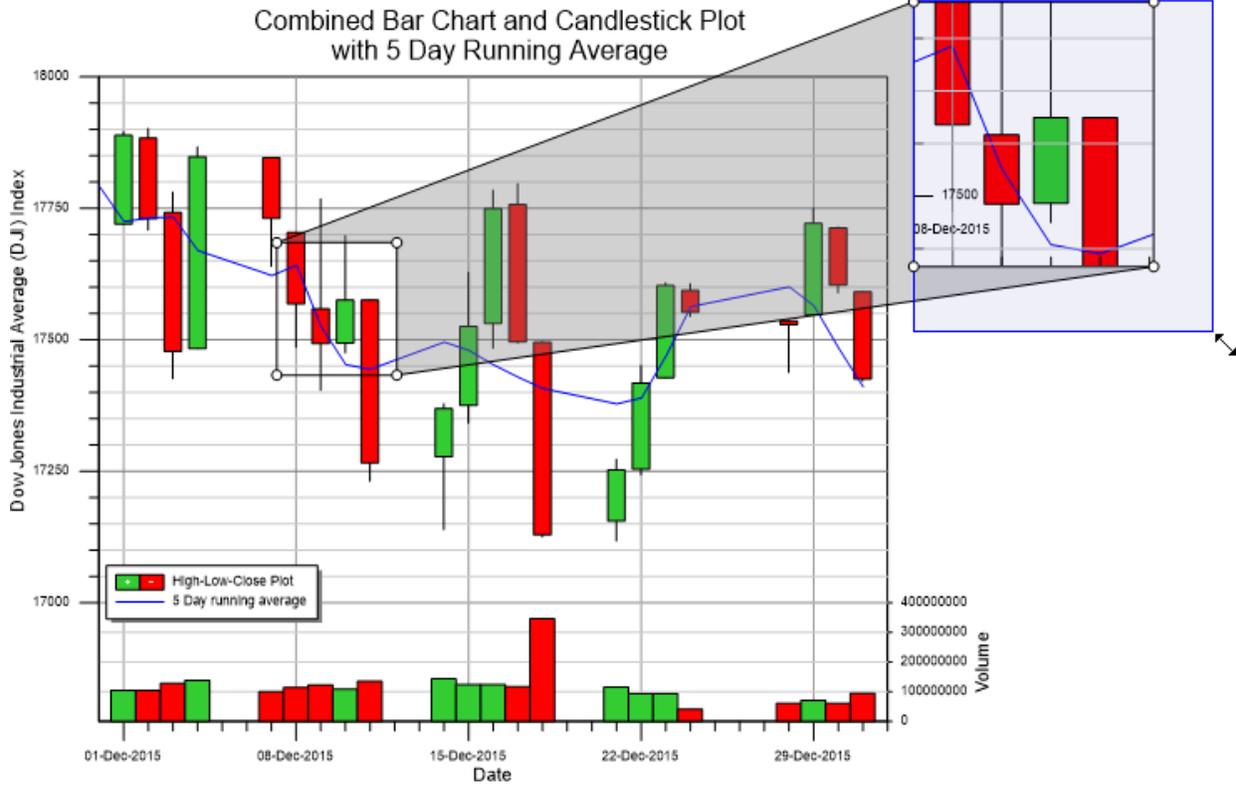
6. Release the cursor and the magnifier is created with the default settings. A *Graph Magnifier 1* object is added to the **Object Manager**.



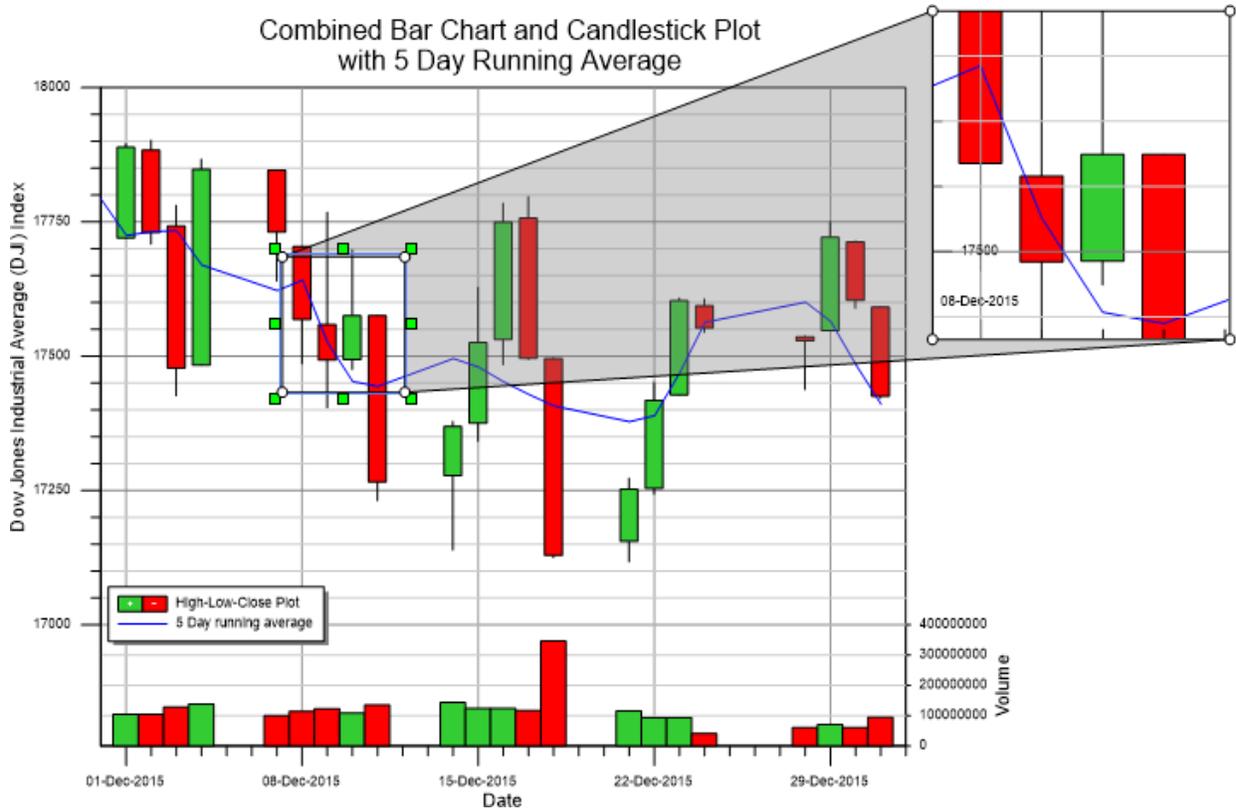
7. Select the *Graph Magnifier 1* in the **Object Manager**.
8. In the **Property Manager**, click the **Magnifier** tab to display the magnifier properties. The *Selected box* is *Zoomed area box* by default. The zoomed area box has six green boxes surrounding it in the plot window, indicating it is selected. Left-click the zoomed area box and drag it to a new location.



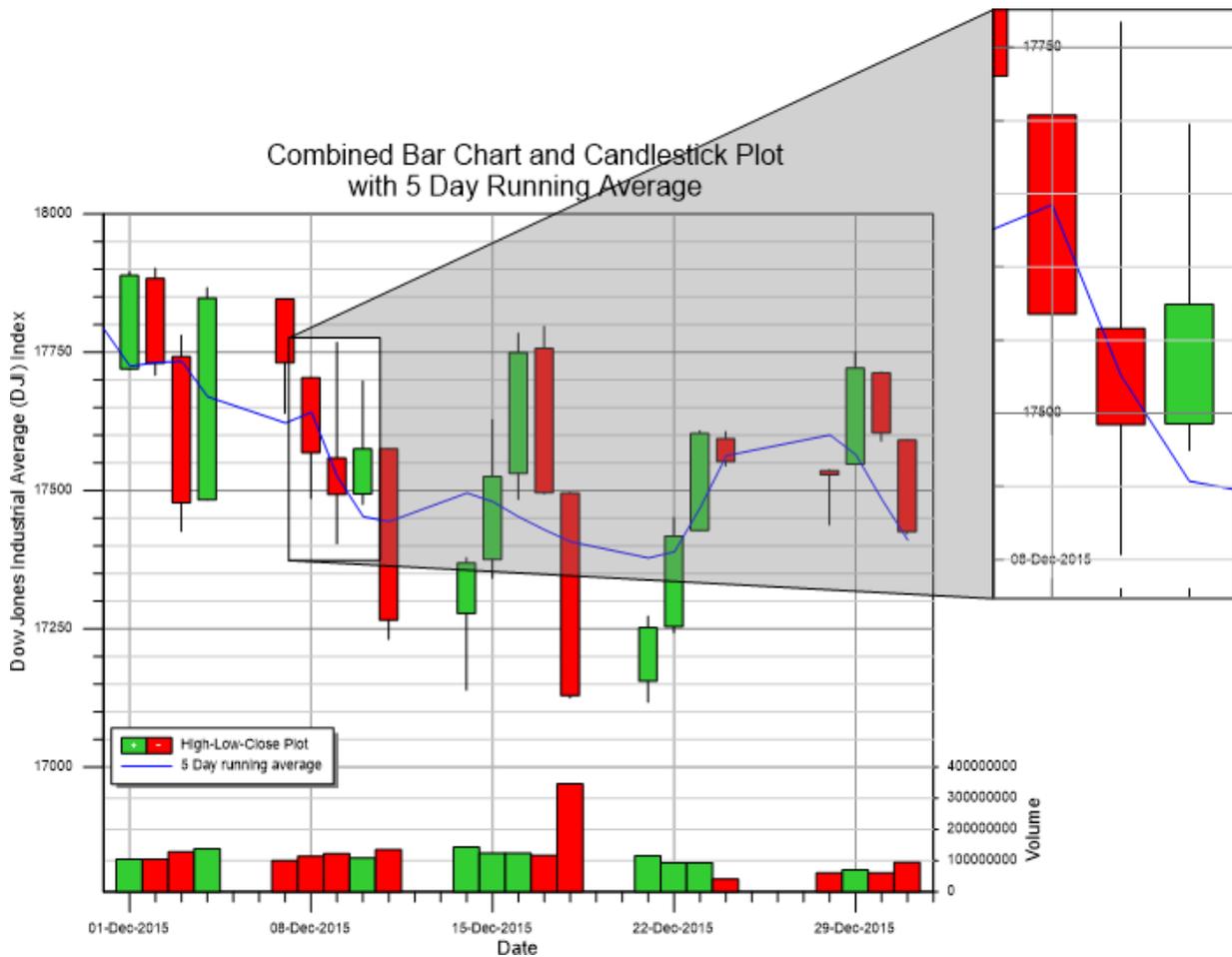
9. Drag the lower-right green box and drag the cursor to resize the zoomed area box.



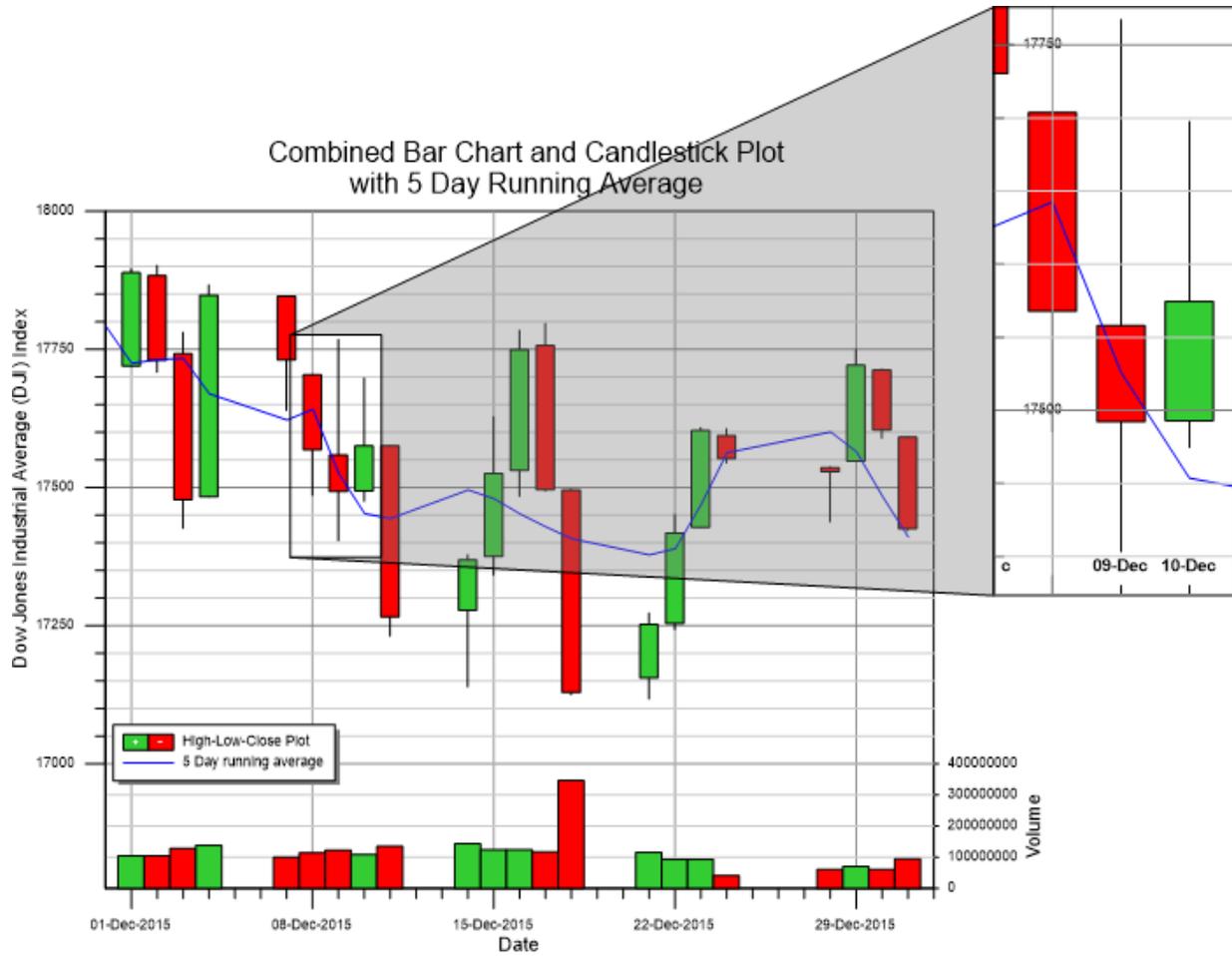
- In the **Property Manager**, click the **Magnifier** tab to display the magnifier properties. Change the *Selected box* to *Area selection box*. The six green squares now surround the area selection box.



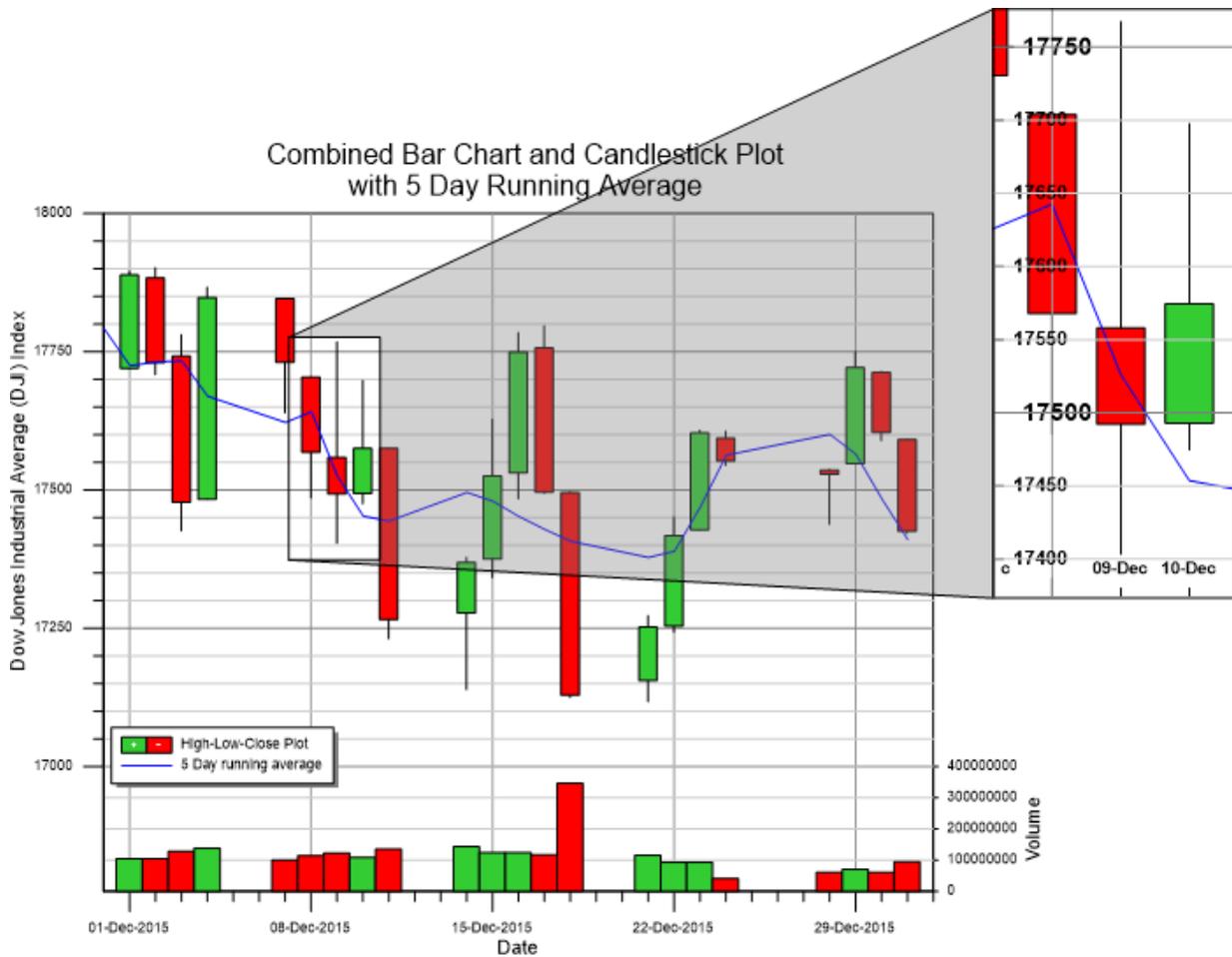
11. Drag a green square to resize the area selection box. The zoomed area box automatically updates to reflect the changes made to the area selection size and location.



12. In the **Property Manager**, click the **Tick Labels** tab to display the tick labels properties. The *X Axis 1* is selected by default.
13. Click the  $\boxplus$  next to *Major Labels* to expand the major label properties.
14. Click the check box next to *Show labels* to clear the box. The major label is removed.
15. Click the  $\boxplus$  next to *Minor Labels* to expand the major label properties.
16. Check the box next to *Show labels*. The minor labels are displayed in the magnifier.
17. Click the  $\boxplus$  next to *Font* to open the minor label font properties.
18. Change the *Size (points)* to 12.
19. Check the box next to *Bold*.
20. Click the  $\boxplus$  next to *Format* to open the minor label format properties.
21. Click the *Select* button in the *Date/time format* field.
22. Type *dd-MMM* in the *Date/Time format* field of the **Date/Time Format Builder** dialog.
23. Click *OK*.



24. Next to *Axes*, click on *X Axis 1* and select *Y Axis 1* from the list.
25. In the *Major Labels* section, expand the *Font* section.
26. In the *Font* section, change the *Size (points)* to 18.
27. Check the box next to *Bold*.
28. In the *Minor Labels* section, check the *Show labels* box.
29. In the *Font* section, change the *Size (points)* to 14.
30. Check the box next to *Bold*.

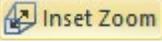


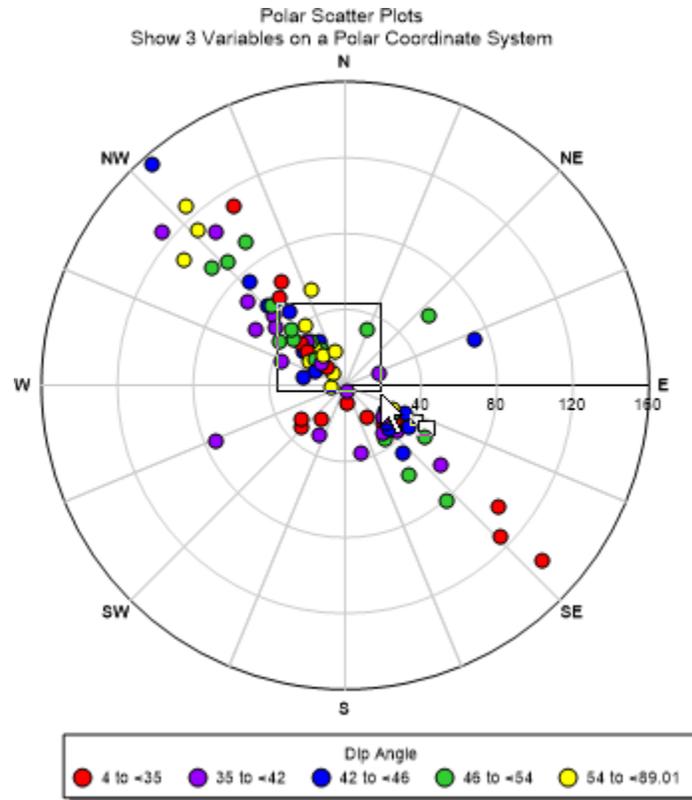
You have now added a magnifier and adjusted various magnifier properties. To magnify a portion of a 3D graph or polar plot, see the [Using the Inset Zoom](#) advanced tutorial lesson.

### Advanced Tutorial - Using the Inset Zoom

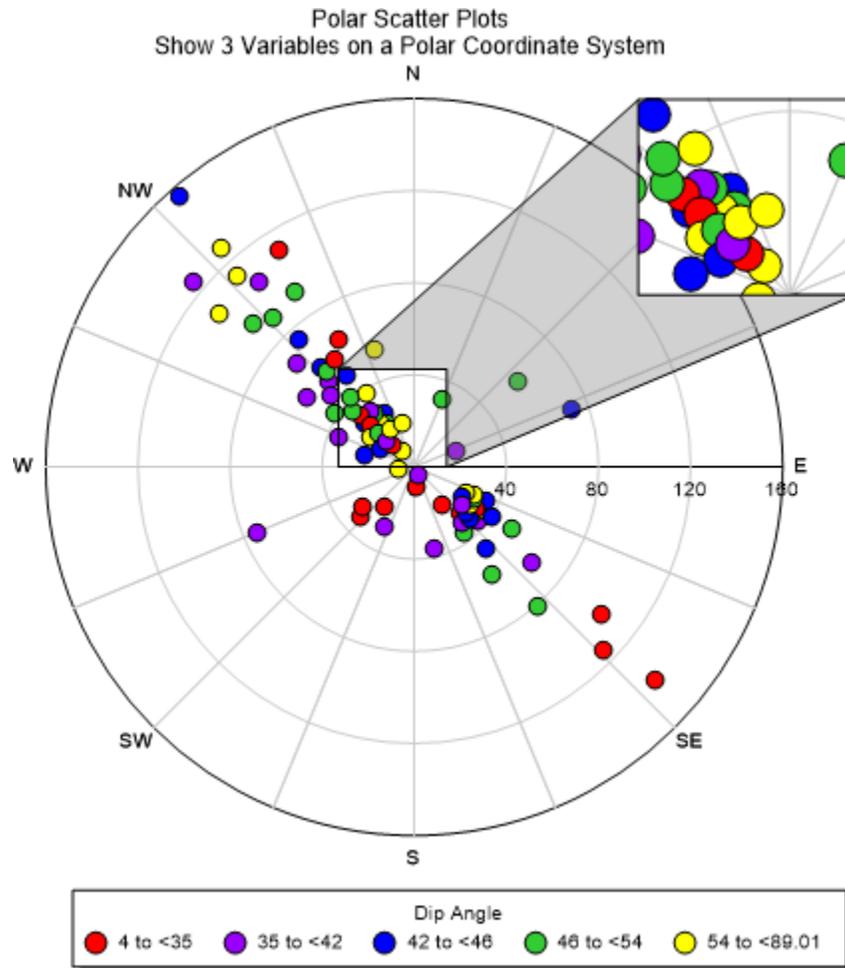
The [Insert | Inset Zoom](#) command  allows you to magnify a graph or any portion of the plot page. This type of inset is similar to changing the zoom level of the screen.

To open a sample file and draw an inset zoom:

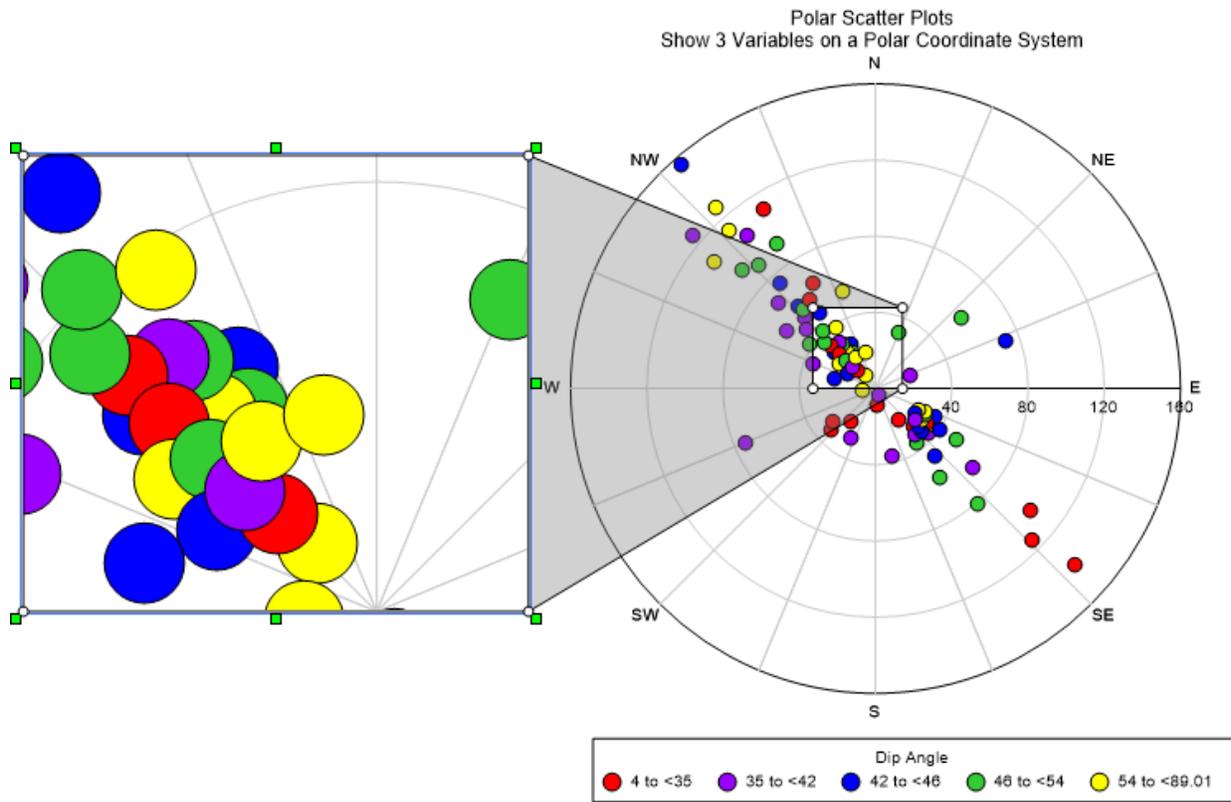
1. Click the **File | Open** command.
2. Navigate to C:\Program Files\Golden Software\Grapher 14\Samples, select *polar class scatter.grf* and click *Open*.
3. Click the [Insert | Inset Zoom](#) command .
4. The cursor changes to . Left-click and drag to define an area to zoom in on.



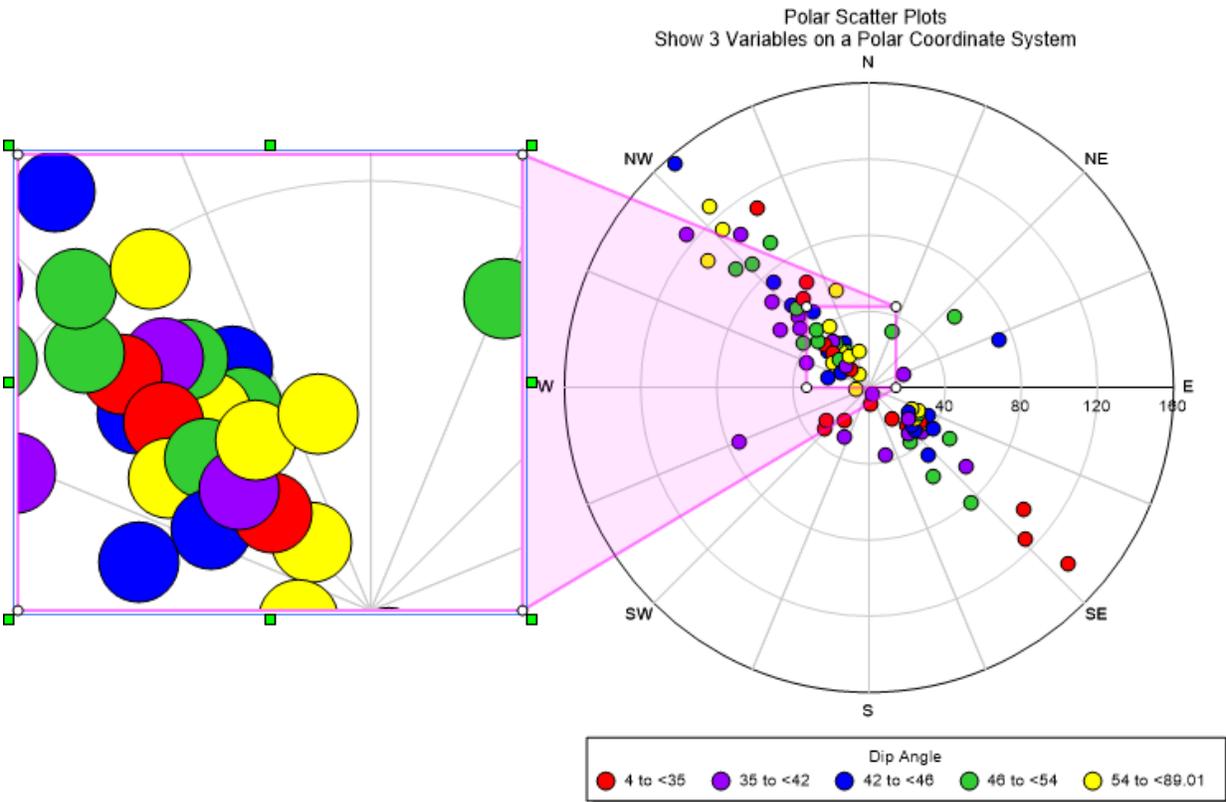
5. Release the cursor and the inset zoom is created with the default settings. An *Inset Zoom 1* object is added to the **Object Manager**.



6. Select the *Inset Zoom 1*. In the **Property Manager**, click the **Magnifier** tab to display the magnifier properties. The *Selected box* is *Zoomed area box* by default. The zoomed area box has six green boxes surrounding it in the plot window, indicating it is selected. Left-click the zoomed area box and drag it to a new location.
7. Drag the lower right green box and drag the cursor to resize the zoomed area box.



8. In the **Property Manager**, click the **Lines** tab to display the lines properties.
9. Click the  $\oplus$  to the left of *Zoom Box* to expand the zoom box section.
10. Click the  $\oplus$  to the left of *Line* to expand the line properties.
11. Next to *Width*, type *0.03 in* and press ENTER.
12. Next to *Color*, click *Black* to open the color palette. Select *Magenta*. The color palette closes and the lines update to the new color.
13. Next to *Opacity*, enter 50% and press ENTER.
14. In the **Property Manager**, click the **Connector** tab to display the connector properties.
15. Click the  $\oplus$  to the left of *Fill style* to expand the fill style properties.
16. Next to *Foreground color*, click *50% Black* to open the color palette. Select *Magenta*. The color palette closes and the lines update to the new color.
17. Next to *Foreground opacity*, enter 10% and press ENTER.



### Combining Plots from Different Graphs

In **Grapher**, a *Graph* is an object that contains the plots, axes, legends, summation plots, and other items used to display data as any of the [plot types](#). *Plots* are the lines, symbols, or bars that display the data on the graph. Plots can be added to a graph with the [Home | Add to Graph | Plot](#) command or can be moved between graphs in the [Object Manager](#).

### Adding a Plot to an Existing Graph

To add a plot to an existing graph:

1. Click on the existing plot, axis, or graph in the **Object Manager** to select it.
2. Click the **Home | Add to Graph | Plot** command.
3. Select the plot type and click *OK*.
4. Set the axes to use for the new plot, if required, and click *OK*.
5. Select the worksheet to use for the new plot, if required, and click *Open*.
6. The new plot is added to the existing graph.

### Dragging a Plot from One Graph to Another

To drag a plot from one graph to another:

1. Click on a plot in the **Object Manager**.
2. Hold down the left mouse button and drag the plot to a different graph object.

3. Release the mouse button.
4. If multiple axes exist in the new graph, select the *Graph*, *X Axis*, and *Y Axis* in the dialog and click *OK*.
5. The plot is moved to the new graph and is drawn using the selected axes. The old graph still exists, but can be deleted if desired.

#### Copying a Plot from One Plot Window to Another

To copy a plot from one plot window to another:

1. Open a .GRF, .GPJ, or .GRT file.
2. Click on a plot in the **Object Manager**.
3. Click the [Home | Clipboard | Copy](#) command.
4. Open another .GRF, .GPJ, or .GRT file.
5. Click the [Home | Clipboard | Paste](#) command.
6. In the [Choose Axes](#) dialog, select the appropriate *Graph*, *X Axis*, and *Y Axis*. Click *OK*.
7. The plot is copied to the new plot window in the appropriate graph.

#### Notes:

- Some plot types, such as radar plots and pie charts, cannot be moved between plots.
- When more than one axis of any type exists on the graph, a dialog appears where you specify which axes to use.
- 2D plots can be moved to 3D plots, but the plot does not become a 3D plot. If you want to move a 2D plot to a 3D plot, first convert the 2D plot to a 3D plot using the [Graph Tools | Convert | Graph to 2D/3D](#) command . Then, drag and drop the 3D plot into the other 3D graph.
- A 3D plot can be moved to a 2D graph. The 3D plot becomes a 2D plot.
- An XYZ plot can be moved to a 2D or 3D graph. If you drag a XYZ plot to a 2D graph, only two dimensions are displayed. If you drag a XYZ plot to a 3D graph, **Grapher** automatically adds a new Z axis.

**Congratulations!** You have completed the **Grapher** advanced tutorial lessons.

## Chapter 3 - Data Files and the Worksheet

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.

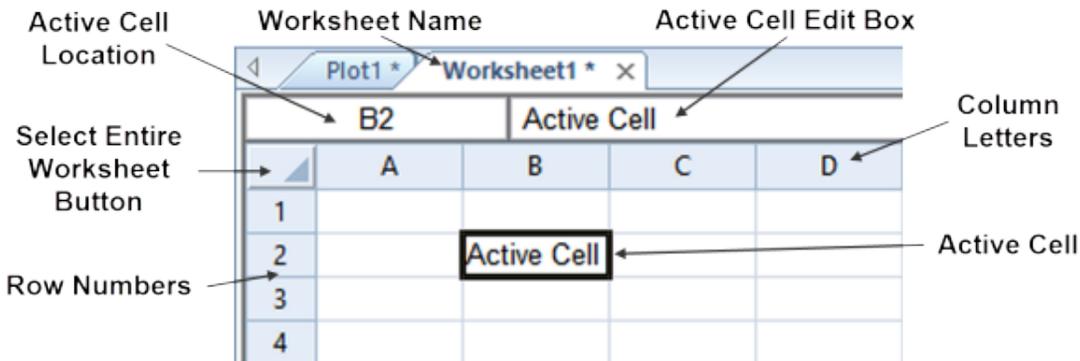
File	Opens, closes, saves, imports, exports, and prints files. Provides links to online references and email templates. Provides access to licensing information and <b>Grapher</b> version number.
Home	Contains clipboard, undo, and graph creation commands.
<a href="#">View</a>	Controls the display of 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.

<a href="#">Column Letters</a>	The column letters identify a column in the worksheet.
<a href="#">Row Numbers</a>	The row numbers identify a row in the worksheet.
<a href="#">Active Cell</a>	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.
<a href="#">Active Cell Location</a>	The active cell location is specified by column letter and row number.
<a href="#">Active Cell Edit Box</a>	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.
<b>Worksheet Name</b>	The worksheet name displays the data file name or the worksheet number if the data file has not been saved.
<a href="#">Select Entire Worksheet Button</a>	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**.

## 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 <a href="#">active cell</a> 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 <a href="#">active cell</a> 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

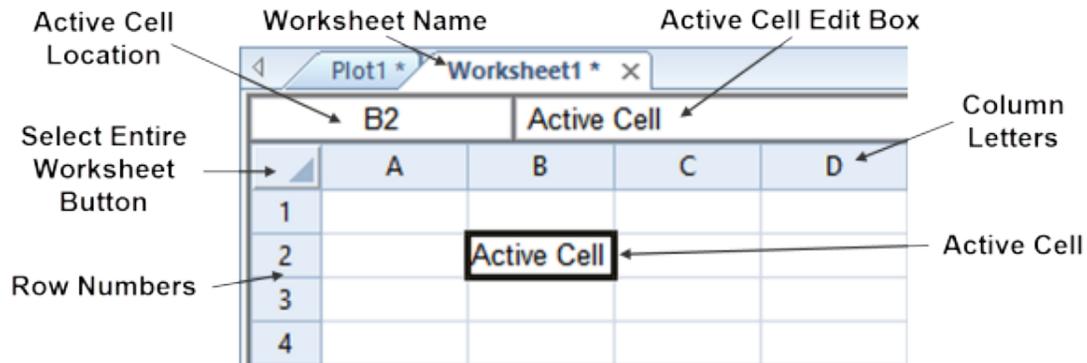
To resize the last selected block, hold down the SHIFT key while clicking and holding the left mouse button. Then, drag the edge of the last selected block to the new position. The last block cannot be resized if the active cell has been moved.

### 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.

## 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.

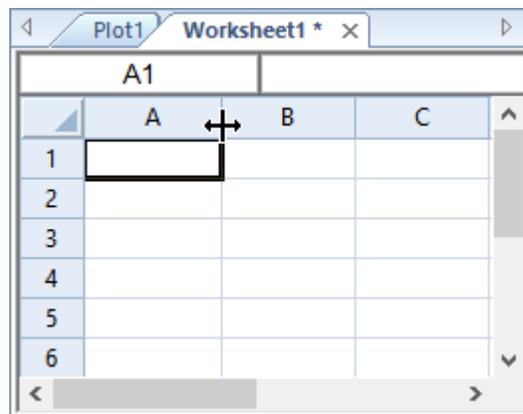


*This example shows columns A, B, C, and D, and rows 1, 2, 3, and 4.*

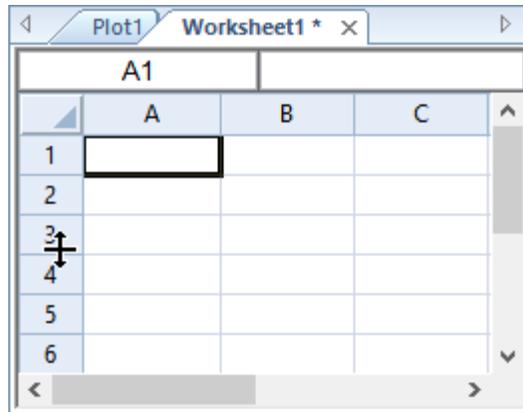
## Selecting a Column or Row Dividing Line

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):  $2.22\text{E-}16$
- Maximum absolute value (the largest value that can be represented):  $1.79769\text{E}+308$
- Minimum absolute value (the smallest value that is different from zero):  $2.22507\text{E-}308$

### Example 1

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

$30,000 \text{ cells} \times 10.5 \text{ bytes/cell} = 315,000 \text{ bytes (308 Kbytes)}$

$3 \text{ columns} \times 24 \text{ bytes/column} = 72 \text{ bytes}$

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

## Active Cell Functions

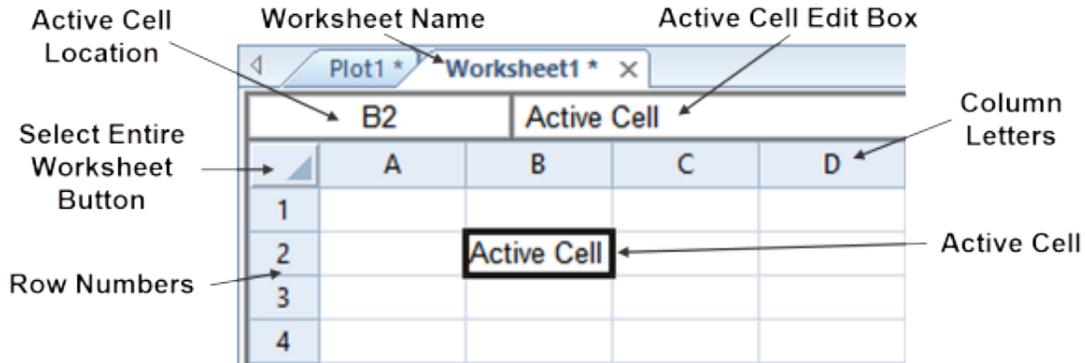
Enter or edit data in the active cell. The contents of the active cell are displayed in the [active cell edit box](#). To edit existing data, activate the desired cell and press the F2 key or highlight the information in the active cell edit box.

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.

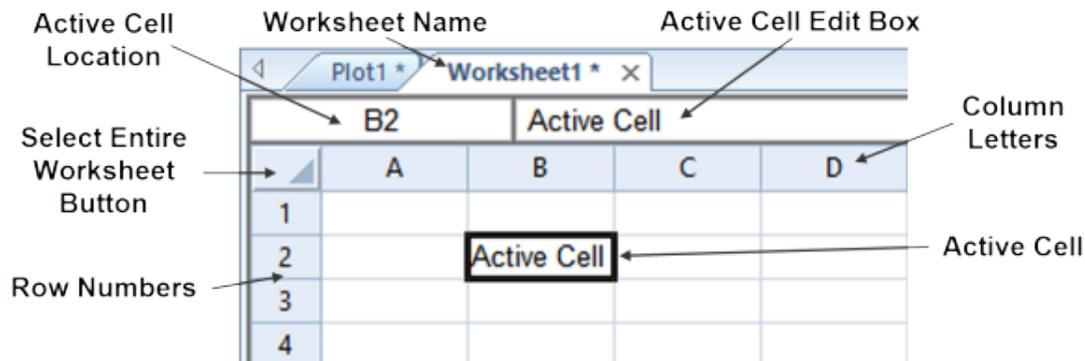
Right-click in the active cell edit box to access the following commands in the context menu:

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:

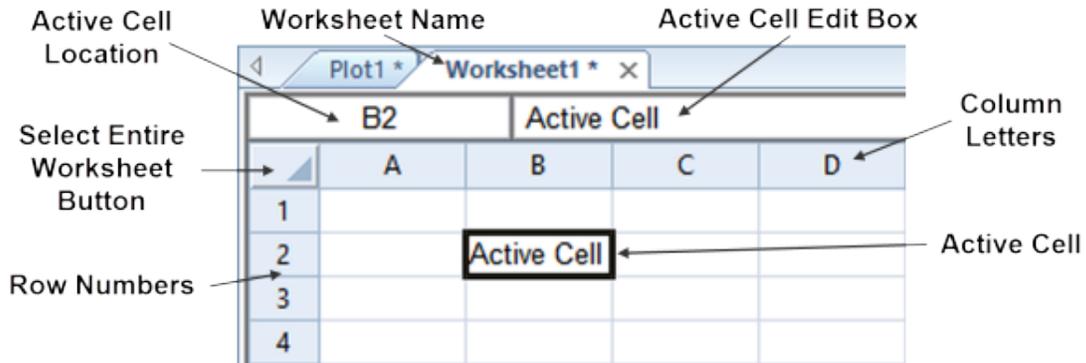
- ENTER stores the contents of the cell edit box and then moves the active cell down one cell.
- CTRL+ENTER completes the entry and keeps the current cell active.
- Left and right ARROWS move within the cell's text if the F2 key has been pressed. Otherwise, these keys store the contents of the cell edit 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".*

## Select Entire Worksheet

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



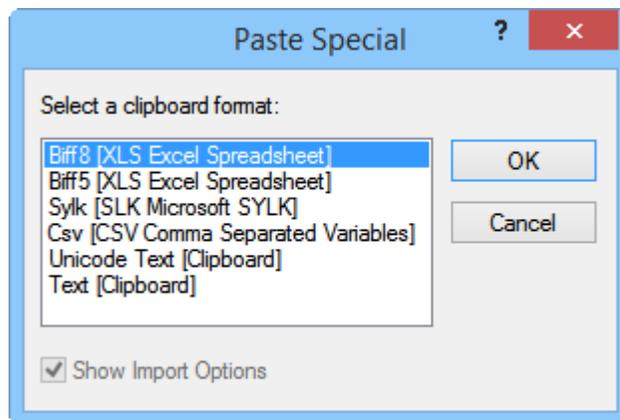
*The Select Entire Worksheet button is located to the left of column A and above row 1.*

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

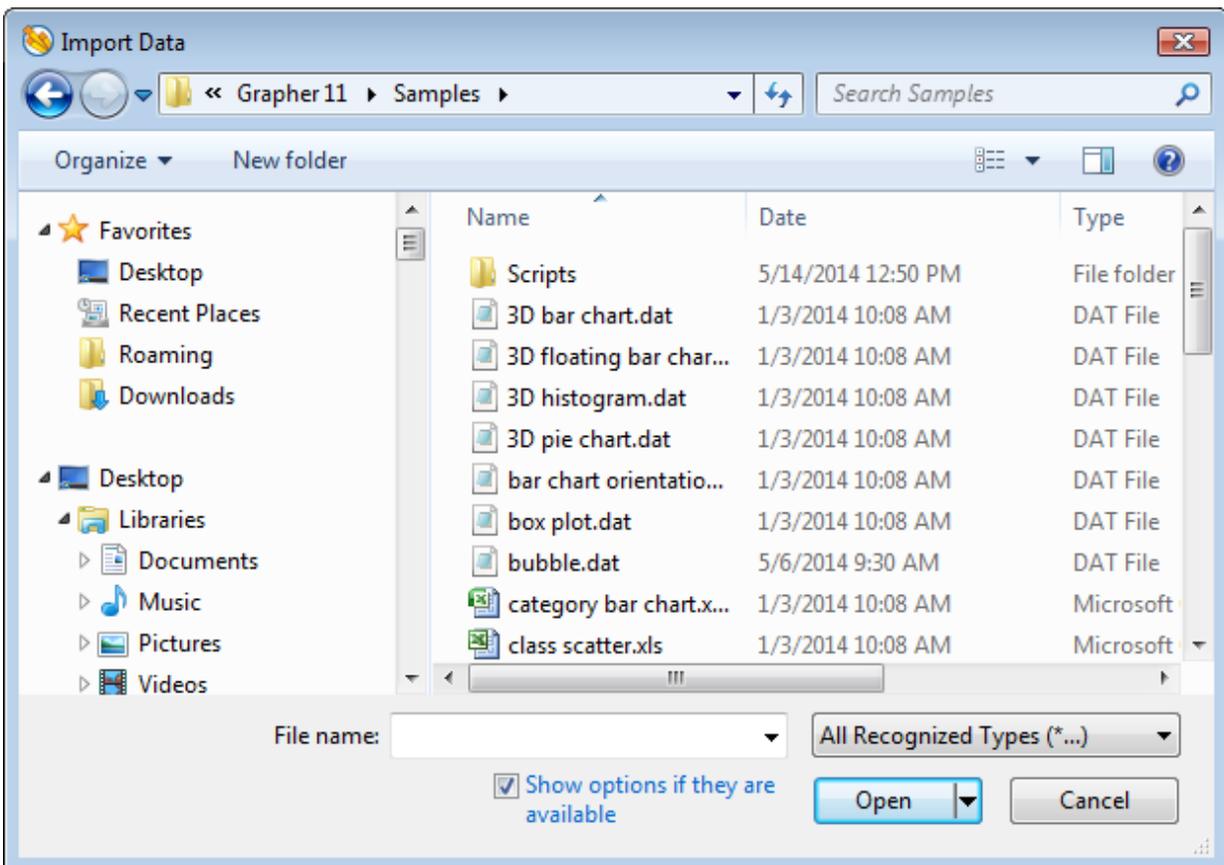
### Show Import Options

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.

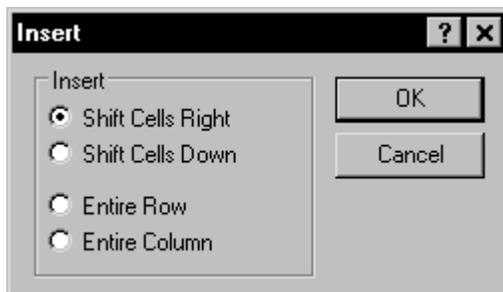
If you wish to reload data in the plot window, click the **File | Reload Data** or **Graph Tools | Worksheet | Reload** command.

## 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

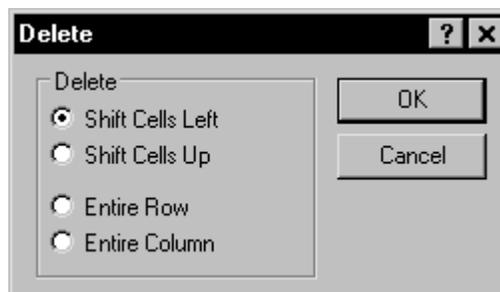
Click the *Shift Cells Down* or *Shift Cells Right* option to insert blank cells and displace the original contents either down or to the right.

### 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

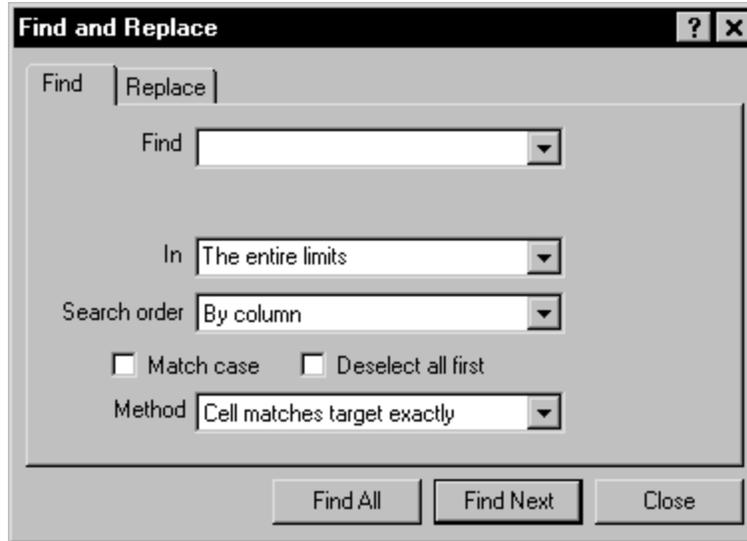
The **Data Tools | Find | Replace** command is used to replace a word or phrase with specified text. The [Find and Replace](#) dialog opens to allow entry of the replacement text.

## 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*.

	A	B
1	3	7
2	4	2
3	5	5
4	6	8
5	7	4
6	8	9
7	9	5

*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

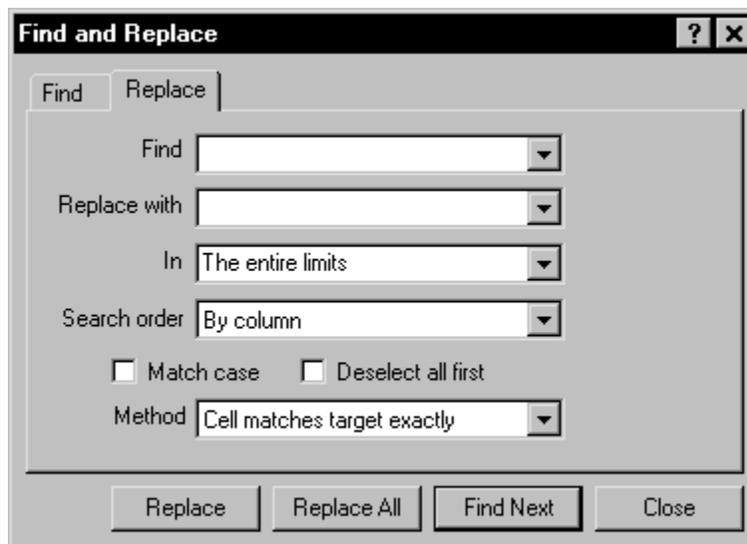
Click the *Find Next* button to find the next occurrence of the characters specified in the *Find* box. This allows you to meet the criteria one at a time. The next instance of the *Find* criteria will be highlighted.

#### 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 *Replace with* 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 *Replace with* 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 *Replace with* 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 backslash "\"). 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.

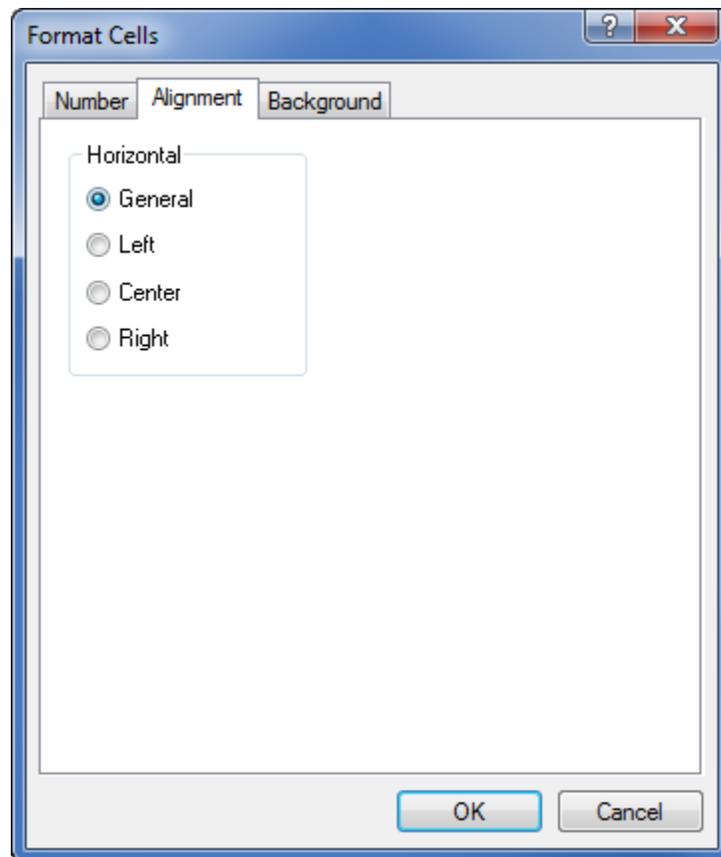
The [Data Tools | Data | Transform](#) command can also be used to perform a [mathematical function](#), such as ATOI(X), to convert some text strings to integer values.

### 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

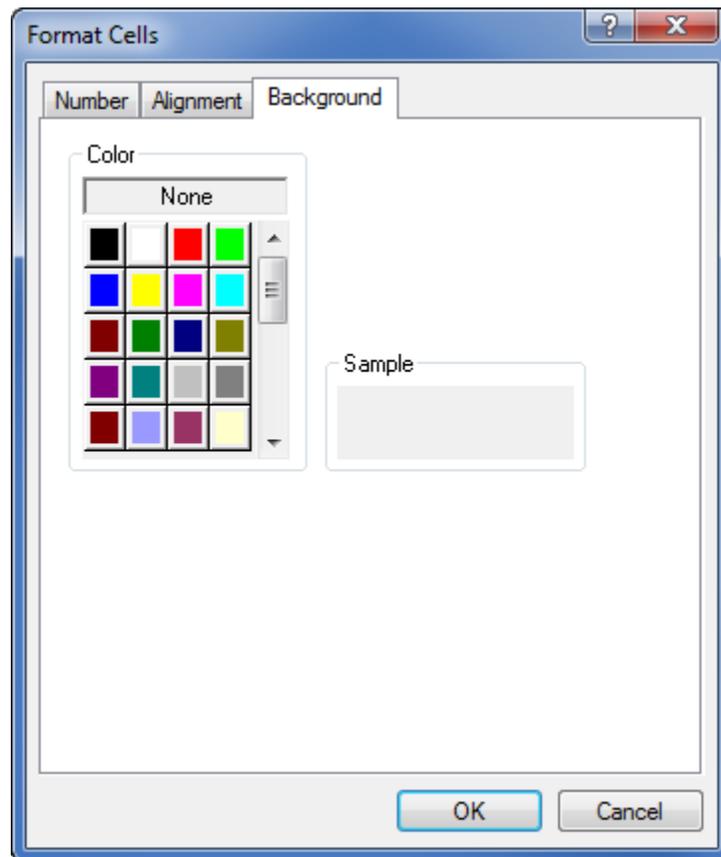
*Center* aligns text, numbers, dates, and time in the center of the cell.

### 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.

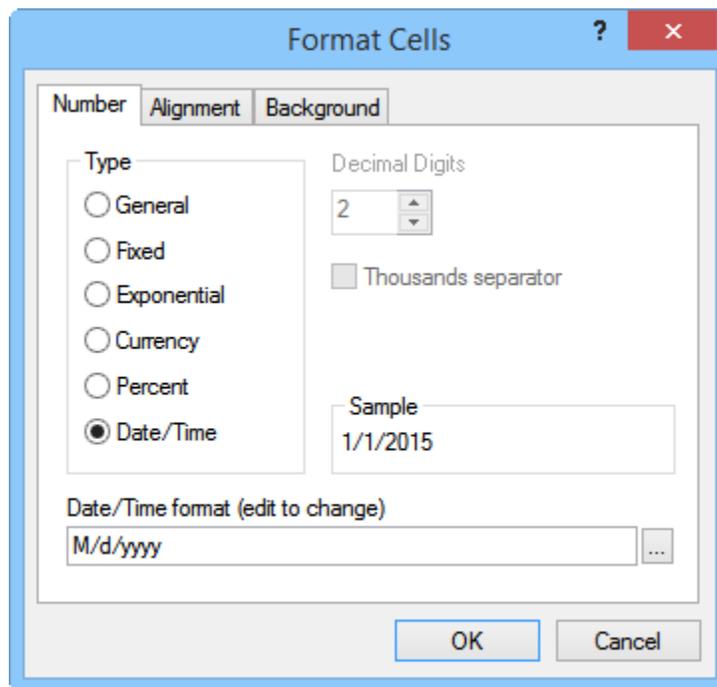
### Sample

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.

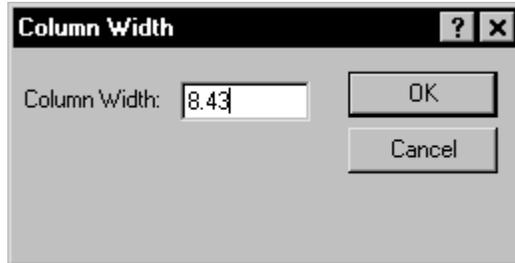
### Column Width

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

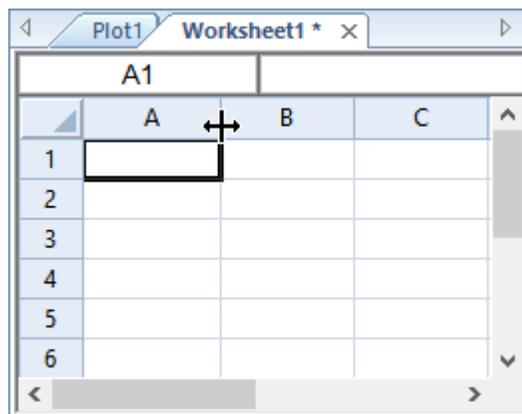
To set column widths or to hide columns, [select](#) the entire column or individual cells within the columns, and then select **Data Tools | Format | Column Width**. Enter the width for the selected column or cells into the **Column Width** dialog. Columns can range from zero to 512 characters wide.



*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

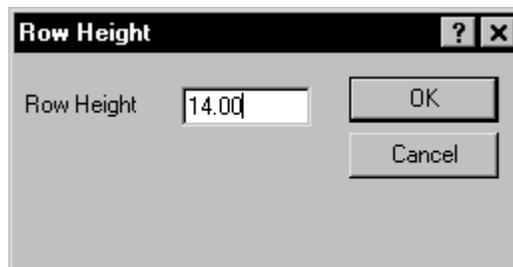
To [display hidden columns](#), press and hold the left mouse button at the right edge of the hidden column and move the cursor to the right to widen the column.

## 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

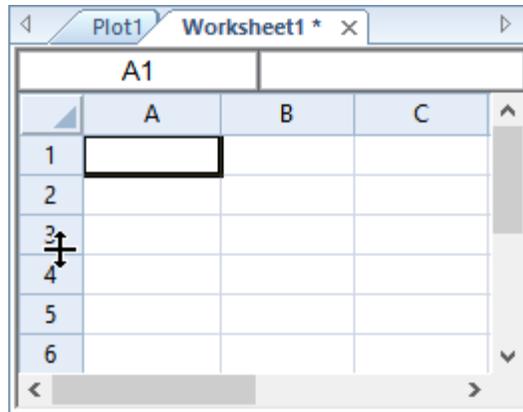
To set row heights or to hide rows, [select](#) the entire row or individual cells within the rows, and then select **Data Tools | Format | Row Height**. Enter the width for the selected row or cells in the **Row Height** dialog. Rows can range from zero to 512 characters in height.



*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

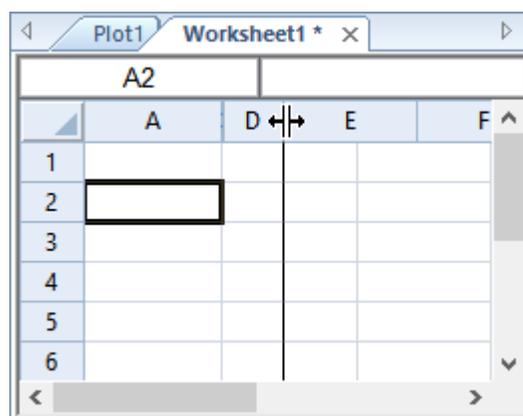
The mouse may be used to display hidden columns or rows.

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.



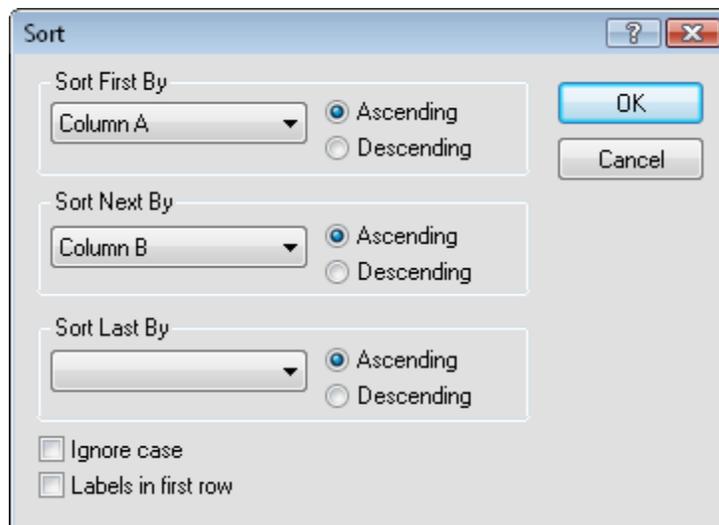
*This example shows the vertical line being dragged to display hidden column D.*

## 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

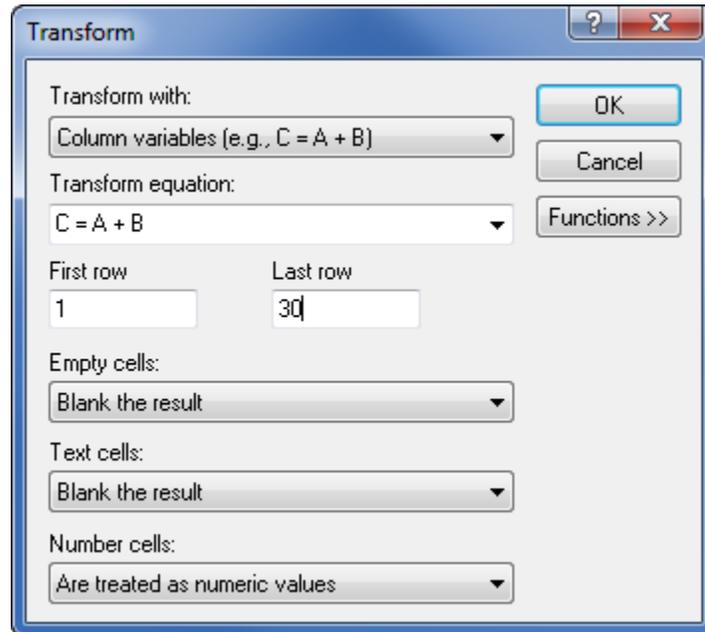
Because sorting is based on an ASCII table, upper and lowercase letters are treated differently. For example, "A" is sorted separately from "a." If the letters are to be treated as the same during the sort, check the *Ignore case* option. When this check box is activated, "A" is considered identical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

### 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.

### 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.

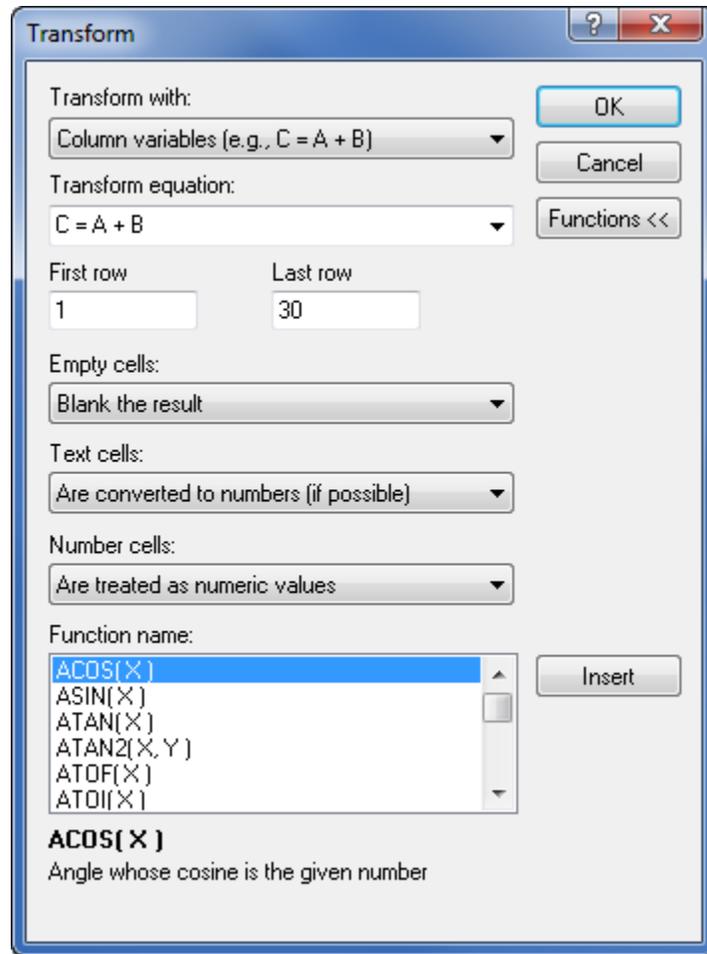
### Functions

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.

### 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* 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.

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

## Bessel Functions

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

## Exponential Functions

<code>exp(x)</code>	exponential function of x (e to the x)
<code>sinh(x)</code>	hyperbolic sine of angle x
<code>cosh(x)</code>	hyperbolic cosine of angle x
<code>tanh(x)</code>	hyperbolic tangent of angle x
<code>ln(x)</code>	natural logarithm of x, x must be positive
<code>log10(x)</code>	base 10 logarithm of x, x must be positive
<code>pow(x,y)</code>	x raised to the $y^{\text{th}}$ power Alternatively use <code>x^y</code> 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
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

<code>rowmin(_1.._5)</code>	finds the minimum value of a range of rows in a column
<code>rowmax(a..z)</code>	finds the maximum value of a range of columns in a row
<code>rowmax(_1.._5)</code>	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

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

<b>SYMBOL</b>	<b>NAME</b>	<b>DESCRIPTION</b>
~	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).

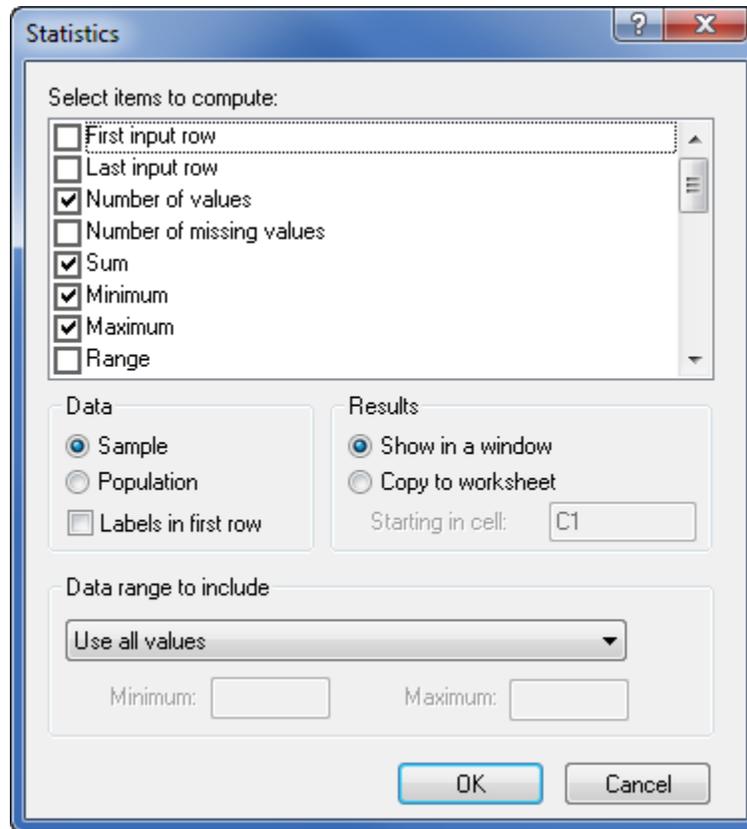
Equation	Mathematical Function Syntax
$x^2$	x^2 OR pow(x,2)
$\ln(x)$	ln(x)
$\log_{10} x$	log10(x)
$1 - e^{-x}$	(1-exp(-X))
$1 - e^{-x^2}$	1-exp(-x^2)
$1 - \frac{\sin(x)}{x}$	1-(sin(x)/x)
$\frac{x^2}{1+x^2}$	x^2/(1+x^2)
$2x - x^2$	(2 * X)-pow(x,2)
$(x^2 + y^2)(\sin(8 \times \tan^{-1} xy))$	(pow(x,2)+pow(y,2))*(sin(8*atan(x*y)))

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 (25<sup>th</sup> percentile)* 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 (75<sup>th</sup> percentile)* 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*.

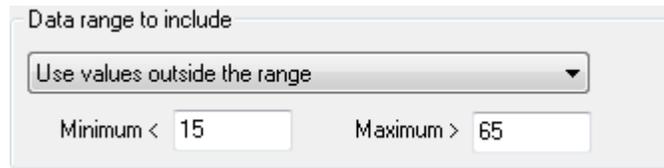
When the *Data range to include* is set to *Use all values*, all of the values in the highlighted section are used to calculate the statistics.

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.

The image shows a dialog box titled "Data range to include". It features a dropdown menu with the text "Use values inside the range" and a downward arrow. Below the dropdown, there are two input fields: "Minimum >=" with the value "15" and "Maximum <=" with the value "65".

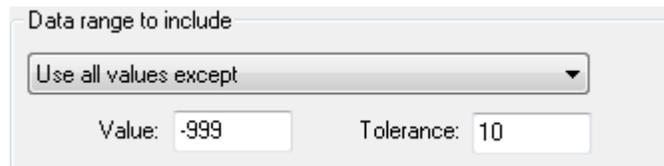
*Only the values that are inside the range are included in the calculated statistics.*

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 Results** 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

$$\pm t_{(n-1), \alpha=0.05} (SE)$$

### 99% Confidence Interval for the Mean

$$\pm t_{(n-1),\alpha=0.01} (SE)$$

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)

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

Sample Mean Deviation (MD)

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

where

$\mu$  = [Population Mean](#)

$\bar{x}$  = [Sample Mean](#)

N = number of data values (for a population)

n = number of data values (for a sample)

$x_i$  =  $i^{\text{th}}$  data value

### Coefficient of Kurtosis

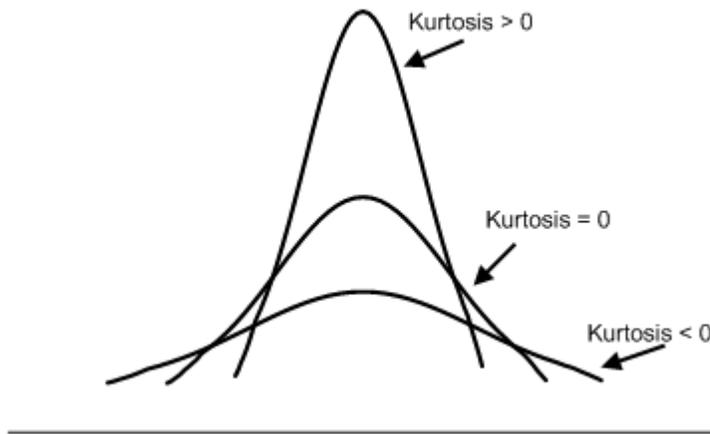
Kurtosis is a measure of the sharpness of the data peak. Traditionally the value of this coefficient is compared to a value of 0.0, which is the coefficient of kurtosis for a normal distribution, i.e., the bell-shaped curve. A value greater than 0 indicates a peaked distribution and a value less than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

Population Kurtosis ( $\gamma_2$ )

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

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

$\sigma$  = [Population Standard Deviation](#)

$S$  = [Sample Standard Deviation](#)

$\mu$  = [Population Mean](#)

$\bar{x}$  = [Sample Mean](#)

$N$  = number of data values for a population

$n$  = number of data values for a sample

$x_i$  =  $i^{\text{th}}$  data value

Coefficient of Skewness

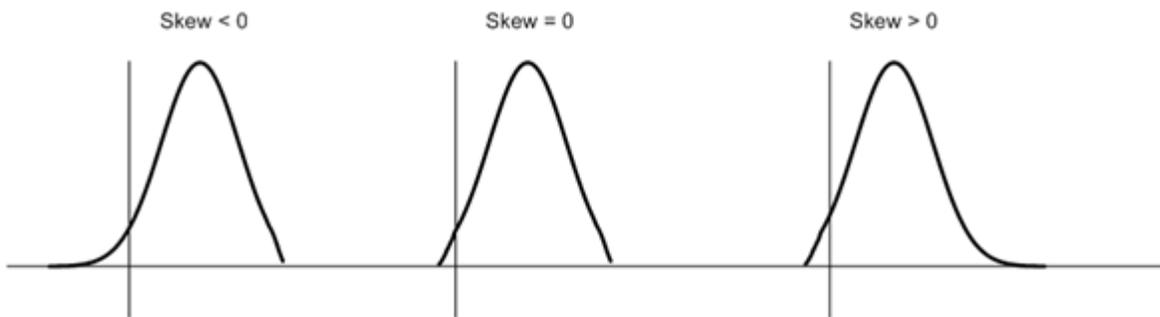
The coefficient of skewness is a measure of asymmetry in the distribution. A positive skew indicates a longer tail to the right, while a negative skew indicates a longer tail to the left. A perfectly symmetric distribution, like the normal distribution, has a skew equal to zero. For small data sets this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

Population Skew ( $\gamma_1$ )

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

Sample Skew ( $\xi_1$ )

$$\xi_1 = \frac{n}{(n-1)(n-2)} \sum \left( \frac{x_i - \bar{x}}{s} \right)^3$$



(adapted from [King and Julstrom](#), 1982)

where

$\sigma$  = [Population Standard Deviation](#)

$S$  = [Sample Standard Deviation](#)

$\mu$  = [Population Mean](#)

$\bar{x}$  = [Sample Mean](#)

$N$  = number of data values for a population

$n$  = number of data values for a sample

$x_i$  =  $i^{\text{th}}$  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

$\sigma$  = [Population Standard Deviation](#)

$S$  = [Sample Standard Deviation](#)

$\mu$  = [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.

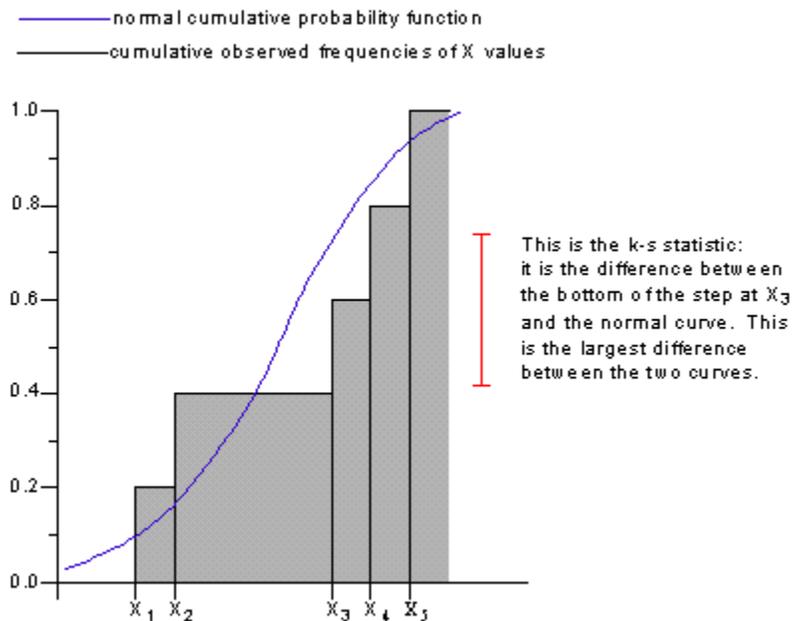
For example, if a sample collected from a population has a normal frequency distribution, the K-S statistic for that sample is less than the critical value 90, 95, or 99 percent of the time. If the K-S statistic is larger than the critical value, the hypothesis that the underlying population is distributed 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 ( $\mu$ )

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

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)

$x_i$  =  $i^{\text{th}}$  data value

Standard Deviation

The standard deviation is the square root of the variance.

Population Standard Deviation ( $\sigma$ )

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

Sample Standard Deviation (S)

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

where

$\sigma^2$  = [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 ( $\sigma^2$ )

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

Sample Variance ( $s^2$ )

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

where

- $\mu$  = [Population Mean](#)
- $\bar{x}$  = [Sample Mean](#)
- $N$  = number of data values (for a population)
- $n$  = number of data values (for a sample)
- $x_i$  =  $i^{\text{th}}$  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

	A4	3
	A	B
1	X	Y
2	1	1
3	2	1
4	3	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.*

*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.

A4		3
	A	B
1	X	Y
2		1
3		2
4		3
5		4
6		5

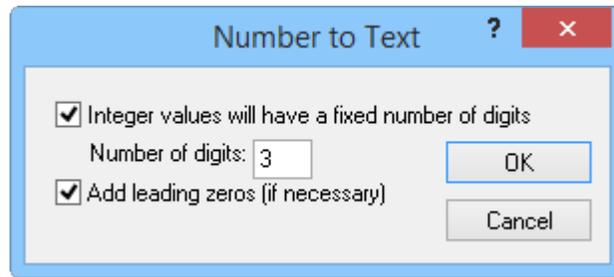
*Notice in this example the Active Cell Edit Box does not contain an apostrophe before the number.*

A4		'003
	A	B
1	X	Y
2		1
3		2
4		'003
5		4
6		5

*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

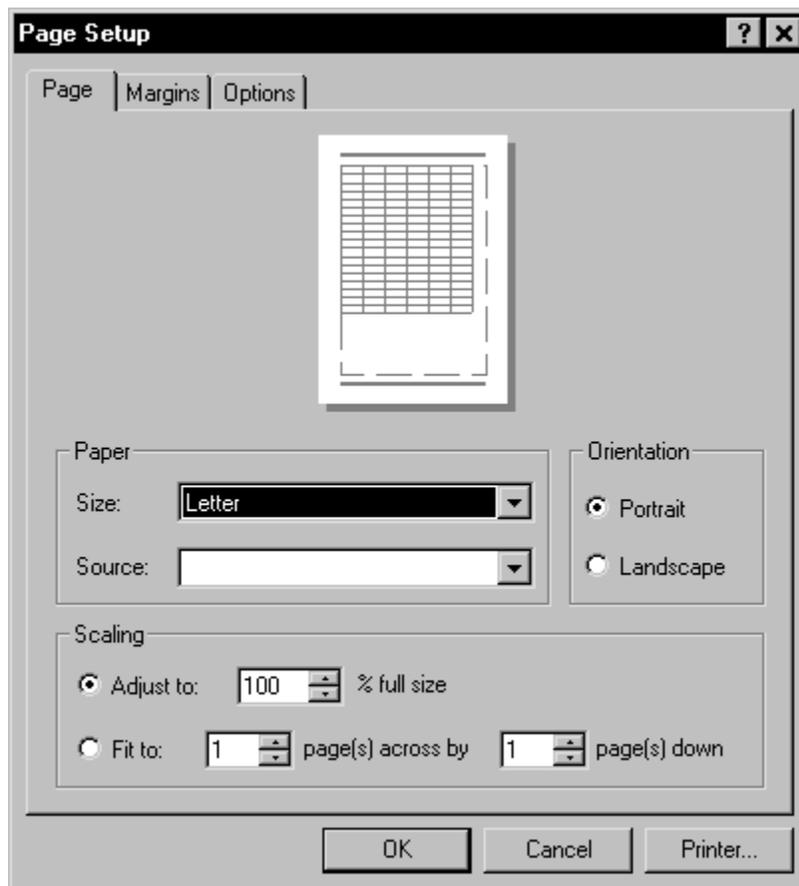
Use the [Margins](#) page to set page margins, header and footer positions, and centering.

## 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.

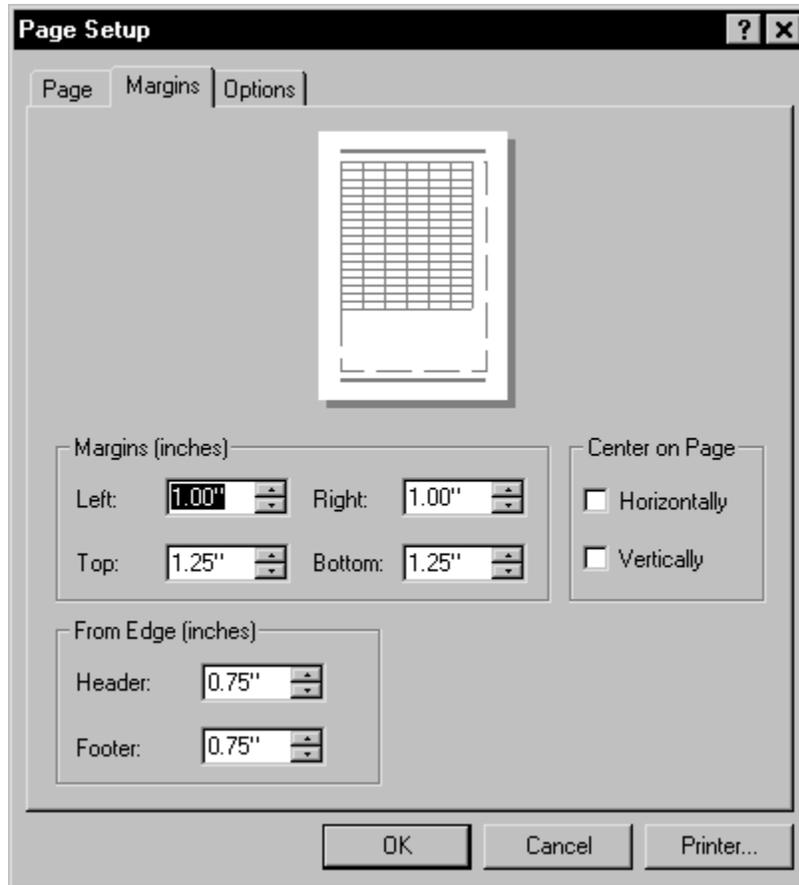
The amount of data in the worksheet determines how many pages are required to print the worksheet. This is independent of the *Fit to* option.

## 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

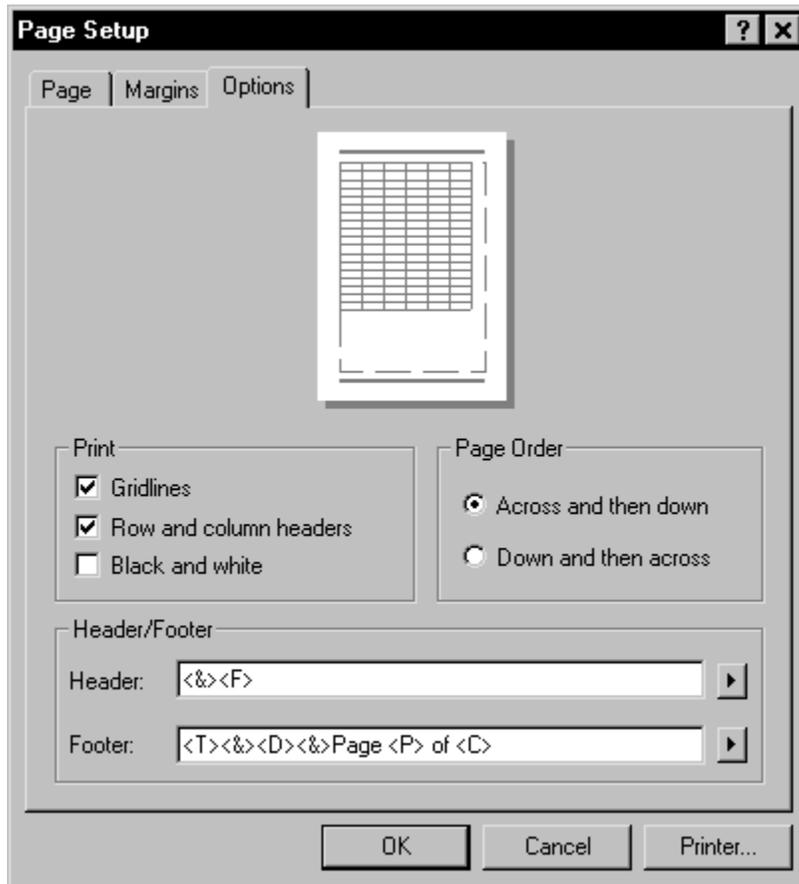
The *Center on Page* options automatically center the printout *Horizontally*, *Vertically*, or both. If this option is not used the worksheet prints in the upper left corner of the page.

### 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 *Bottom Margins* 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
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Enter Joe Smith< & > < F > < & > < D > to print out a name, file name, and date:

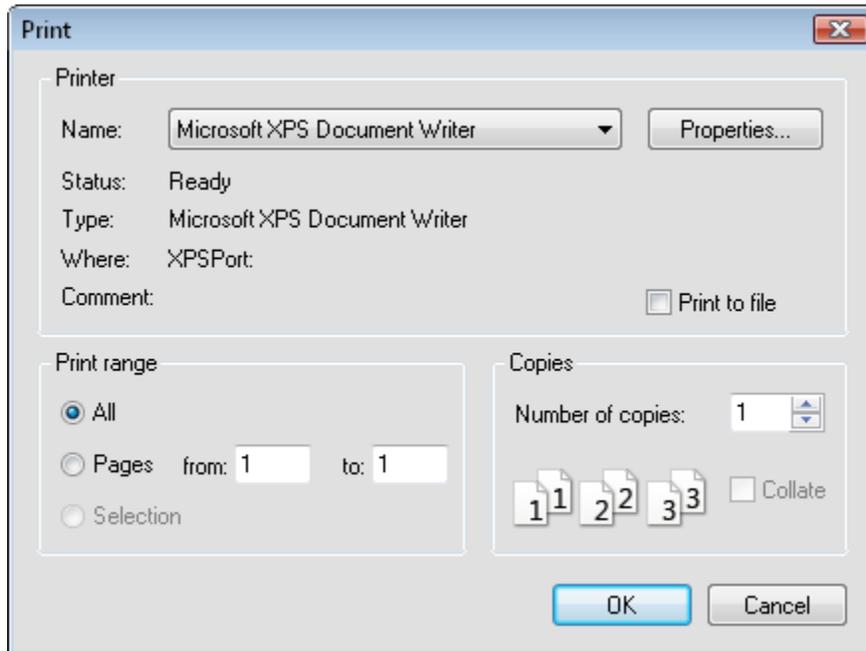
Smith	Joe COLORADO.DAT	01/05/10
-------	---------------------	----------

To print centered text use the "&" operator one time, such as < & > < F >:

FILENAME.DAT
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## 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.