Surfer®
Powerful contouring, gridding & surface mapping system

Full User’s Guide
Surfer® Registration Information

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

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

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

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

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NC NetCDF File Description .................................................................................................... 1196
PDF Adobe Acrobat Portable Document Format [.PDF] File Description ............................... 1198
PLT Golden Software PlotCall File Description ....................................................................... 1207
PLY Stanford Polygon File Description .................................................................................. 1209
PNG Portable Network Graphic File Description .................................................................... 1210
PNM Portable Any Map File Description ................................................................................ 1210
RAS, SUN Sun Raster Image (SUN, RAS) File Description ...................................................... 1212
RAW Binary Lattice File Description ....................................................................................... 1212
RGB Silicon Graphics (RGB) Image File Description .............................................................. 1218
RST Idrisi Raster Image [.RST, .IMG] File Description ............................................................. 1218
RT* TIGER/Line File Description ........................................................................................... 1219
SEG SEG-SP1 Data File Format ............................................................................................... 1220
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TGA Truevision Targa [.TGA] File Description ................................................................ 1238
TIF Tagged Image File Description .................................................................................... 1239
TXT Formatted Text Grid [.FTG, .CSV, .DAT, .TXT] File Description ................................. 1242
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Chapter 1 - Introduction

Welcome to Surfer, a powerful contouring, gridding, and surface mapping package for scientists, engineers, educators, or anyone who needs to generate maps quickly and easily. Producing publication quality maps has never been quicker or easier. Adding multiple map layers and objects, customizing the map display, and annotating with text creates attractive and informative maps. Virtually all aspects of your maps can be customized to produce the exact presentation you want.

Surfer is a grid-based mapping program that interpolates irregularly spaced XYZ data into a regularly spaced grid. Grids may also be imported from other sources, such as the United States Geological Survey (USGS). The grid is used to produce different types of maps including contour, color relief, and 3D surface maps among others. Many gridding and mapping options are available allowing you to produce the map that best represents your data.

An extensive suite of gridding methods is available in Surfer. The variety of available methods provides different interpretations of your data, and allows you to choose the most appropriate method for your needs. In addition, data metrics allow you to map statistical information about your gridded data. Surface area, projected planar area, and volumetric calculations can be performed quickly in Surfer. Cross-sectional profiles can also be computed and exported.

The grid files can be edited, combined, filtered, sliced, queried, and mathematically transformed. For example, grids can be sliced to create cross-sectional profiles, or the Grids | Calculate | Math command can be used to create an isopach map from two grid files. Grids can be edited with an intuitive user interface in the grid editor.

Scripter

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

New Features

The new features in Surfer are summarized:

- Online at https://support.goldensoftware.com/hc/en-us/articles/115001386073
- In the web help at http://surferhelp.goldensoftware.com/#t=topics%2Fnew_features.htm
- In the program, click the help button 📚, and click on the New Features page in the Introduction book

Who Uses Surfer?

People from many different disciplines use Surfer. Since 1984, over 100,000 scientists and engineers worldwide have discovered Surfer’s power and simplicity. Surfer’s outstanding gridding and contouring capabilities have made Surfer the software of choice for working with XYZ data. Over the years, Surfer users have included hydrologists, engineers, geologists, archeologists, oceanographers, biologists, foresters, geophysicists, medical researchers, climatologists, educators, students, and more! Anyone wanting to visualize their XYZ data with striking clarity and accuracy will benefit from Surfer’s powerful features!

System Requirements

The system requirements for Surfer are:

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

Installation Directions
Installing Surfer requires Administrator rights. Either an administrator account can be used to install Surfer, or the administrator's credentials can be entered before installation while logged in to a standard user account. Golden Software does not recommend installing Surfer 16 in the same location as any previous versions of Surfer. Surfer can coexist with older versions (e.g. Surfer 15) as long as both versions are installed in different directories. By default the program installation directories are different. For detailed installation directions see the Readme.rtf file.

To install Surfer from a download:
1. Download Surfer according to the emailed directions you received.
2. Double-click on the downloaded file to begin the installation process.
3. Once the installation is complete, run Surfer.
4. License Surfer by activating a single-user license product key or connecting to a license server.

Updating Surfer
To update your version of Surfer, open the Surfer program and choose the File | Online | Check for Update command. This will launch the Internet Update program which will check Golden Software's servers for any updates. If there is an update for your version of Surfer (e.g. Surfer 16.0 to Surfer 16.1), you will be prompted to download the update.

You can also email your registered Surfer product key to surfersupport@goldensoftware.com and request to download the full product update. See the Check for Update topic in the help for additional information.

Uninstalling Surfer
To uninstall Surfer, follow the directions below for your specific operating system.

Windows 7
To uninstall Surfer go to the Windows Control Panel and click the Uninstall a program link. Select Surfer 16 from the list of installed applications. Click the Uninstall button to uninstall Surfer.

Windows 8
From the Start screen, right-click the Surfer 16 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 Surfer 16 tile and click Uninstall at the bottom of the screen.

Windows 10
Select Settings in the Start menu. In Settings, select System | Apps & features. Select Surfer 16 and then click Uninstall. To uninstall Surfer from the Windows Control Panel, click Programs | Programs and Features. Select Surfer 16 and click Uninstall.

Surfer Trial Functionality
The Surfer trial is a fully functioning time-limited trial. This means that commands work exactly the same as they do 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 version can be licensed by activating a product key or connecting to a license server.
Three-Minute Tour
We have included several sample files with Surfer so that you can quickly see some of Surfer’s capabilities. Only a few files are discussed here, and these examples do not include all of Surfer’s many map types and features. The Contents window is a good source of information as to what is included in each file.

To see the example files:
1. Open Surfer.
2. Click the File | Open command.
3. In the Open dialog, navigate to the Surfer Samples folder. The Surfer Samples folder is located in C:\Program Files\Golden Software\Surfer 16\ by default.
4. Select the sample .SRF file of interest and click Open. The sample file is now displayed. Repeat as necessary to see the files of interest.

Using Surfer
The most common application of Surfer is to create a grid-based map from an XYZ data file. The Grid Data command uses an XYZ data file to produce a grid file. The grid file is then used by most of the Home | New Map commands to produce maps. Post maps and base maps do not use grid files. The general steps to progress from an XYZ data set to a finished grid-based map are as follows:

1. Create an XYZ data file. This file can be created in a Surfer worksheet window or outside of Surfer (using an ASCII text editor or Microsoft Excel, for example).

Start with irregular XYZ data in three columns.

2. To display the data points, click the Home | New Map | Post command.
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3. Create a grid file .GRD from the XYZ data file using the **Home | Grid Data | Grid Data** command.

4. To create a map, select the map type from the **Home | New Map** commands. Select the grid file from step two. Grid-based maps include contour, 3D surface, 3D wireframe, color relief, vector, watershed, viewshed, and grid values maps.
5. Click on the map to display the map properties in the Properties window where you can customize the map to fit your needs.

6. Click the File | Save command to save the project as a Surfer .SRF file which contains all the information needed to recreate the map.
Surfer Flow Chart
This flow chart illustrates the relationship between XYZ data files, grid files, vector files, image files, and various maps. This example displays only one of the grid based maps, a filled contour map.

Using Scripter
Tasks can be automated in Surfer 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 Surfer. Scripts are useful for automating repetitive tasks and consolidating a sequence of steps. Scripter is installed in the same location as Surfer. Refer to the Surfer 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.

To run a sample script file:
1. Open Scripter by navigating to the installation folder, C:\Program Files\Golden Software\Surfer 16\Scripter. If you are running a 32-bit version of Surfer on a 64-bit version of Windows, navigate to C:\Program Files (x86)\Golden Software\Surfer 16\Scripter. Right-click on the Scripter.exe application file and select Run as administrator.
2. Choose the File | Open command.
3. Select a sample script .BAS file. These are located in the C:\Program Files\Golden Software\Surfer 16\Samples\Scripts folder or, if you are running a 32-bit version of Surfer on a 64-bit version of Windows, the C:\Program Files (x86)\Golden Software\Surfer 16\Samples\Scripts folder.
4. Click the Script | Run command and the script is executed. Most sample scripts open Surfer and display a map in the plot window.

Surfer User Interface
Surfer contains four document window types: the plot document, worksheet document, 3D view, and grid editor. Maps are created and displayed in the plot document and 3D view. The worksheet document displays, edits, transforms, and saves data in a tabular format. The grid editor displays and edits Z values for the grid with various editing tools.
**Surfer Layout**

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

<table>
<thead>
<tr>
<th>Component Name</th>
<th>Component Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title Bar</strong></td>
<td>The title bar lists the program name plus the saved Surfer .SRF file name (if any). An asterisk after the file name indicates the file has been modified.</td>
</tr>
<tr>
<td><strong>Quick Access Toolbar</strong></td>
<td>All window types in <strong>Surfer</strong> include the quick access toolbar to the left of the title bar. The quick access toolbar contains buttons for many common commands. The quick access toolbar can be customized to add or remove buttons with the Customize Ribbon command.</td>
</tr>
<tr>
<td><strong>Ribbon</strong></td>
<td>The ribbon includes all commands in <strong>Surfer</strong>. Commands are grouped under the File menu and various tabs. Some commands and tabs are only available in specific views. For example, the Features</td>
</tr>
<tr>
<td><strong>Tabbed Documents</strong></td>
<td>The plot, 3D view, worksheet, and grid editor windows are displayed as tabbed documents. The tabs may be reordered by clicking and dragging. When more than one window is open, tabs appear at the top of the document, allowing you to click</td>
</tr>
</tbody>
</table>
on a tab to switch to a different window. When a document contains unsaved changes, an asterisk (*) appears next to its tabbed name.

**Contents**  
The *Contents* window contains a hierarchical list of all the objects in a Surfer plot document, grid editor, or 3D view window displayed in a tree view. The objects can be selected, added, arranged, or edited. Changes made in the *Contents* window are reflected in the plot document, grid editor, or 3D view and vice versa. The *Contents* window is initially docked at the left side of the window.

**Properties**  
The *Properties* window contains all the properties for the selected object or objects. Changes made in the *Properties* window are reflected in the plot document, grid editor, or 3D view. The properties in the *Properties* window are grouped by page. The *Properties* window is initially docked below the *Contents* window.

**Status Bar**  
The status bar displays information about the current command or activity in *Surfer*. The status bar is divided into five sections. The sections display basic plot commands and descriptions, the name of the selected object, the cursor map coordinates and units, the cursor page coordinates, and the dimensions of the selected object.

**Opening Windows**  
Selecting the *File | Open* command opens any of the three window types, depending on the type of file selected. The *File | New | Plot* command creates a new plot window. The *File | New | Worksheet* command creates a new worksheet window. The *Map Tools | View | 3D View* command opens a 3D view of the selected map. The *Grids | Editor | Grid Editor* command opens a grid in the grid editor.

**Ribbon**  
The Ribbon is the strip of buttons and icons located above the manager and view windows. The Ribbon replaces the menus and toolbars found in earlier versions of *Surfer*. 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*, *Features*, and *Map Tools*. Clicking or scrolling to a tab displays the commands located in this section of the ribbon. The tabs have commands that are organized into a group. For instance, all the commands for adding drawn objects are on the *Features* tab in the *Insert* group.

![The Ribbon is displayed with the Data tab selected.](image)

**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 *Surfer* 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. Double-click any tab name to quickly minimize or maximize the ribbon.
Customizing the Ribbon

The ribbon is customizable in Surfer. To customize the commands in the ribbon, right-click on the ribbon and select **Customize the Ribbon**.

In the **Customize Ribbon** dialog, you can add new tabs, add groups, hide existing tabs or custom groups, and add commands to any custom group. You can also rearrange the tabs into an order that fits your needs better.

To customize the commands in the **Customize Ribbon** dialog, right-click on the ribbon and select **Customize the Ribbon**. In the **Customize Ribbon** dialog, use the following options.

**Tab options**

- 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.
- To delete custom tab, right-click on the tab name in the list on the right side of the dialog and select **Delete**.
- 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.
- 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.
- 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**

- To add a custom group to a default or custom tab, click on the instrument icon 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.
- 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**.
- 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.
- 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.
- 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 you wish to edit the commands in default group, the default group should be hidden and a new custom group should be created with the same commands.

- 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 button 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 button and the command is added to the custom group.
- 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.
- 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.
- 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.

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

Command and Help Search
The ribbon also includes a command search to the right of the last tab (View, Data, or Grid Editor 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 post into the command search bar and the Home | New Map | Post command group, Map Tools | Add to Map | Layer command group, and Map Tools | Edit Layer | Post Labels commands are displayed in the search results. You can also click the 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.

Quick Access Toolbar
The quick access toolbar is at the top of the Surfer 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 Surfer.

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 toolbar.

To customize the commands on the quick access toolbar, right-click on the quick access toolbar or ribbon and select Customize Quick Access Toolbar.
In the Quick Access Toolbar 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 Main 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.

Displaying the Quick Access Toolbar Below the Ribbon
To display the quick access toolbar below the ribbon, right-click on the quick access toolbar or ribbon and click 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.

Tabbed Documents
The plot, 3D view, worksheet, and grid node editor windows are displayed as tabbed documents. When more than one window is open, tabs appear at the top of the screen, allowing you to click on a tab to switch to that window.

Selecting and Closing Windows
To select a tab to view, click the tab name. To close a tab, right-click and select Close or click the X next to the tab name. If unsaved changes are present in the document, you will be prompted to save the changes before the file is closed.

Change Order of Tabs
When viewing in tabbed document mode, the tabs may be dragged to reorder them. Left-click on a tab, hold the left mouse button, drag to a new location, and release the mouse button to move the tab to a new location.

To move to the next tab, you can use the Next command. Alternatively, press CTRL + F6 to move to the next tab.
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The < and > buttons on the sides of the tabs are used to scroll the tabs should there be more tabs than can fit along the top of the window.

Unsaved Changes
When a document contains unsaved changes, an asterisk (*) appears next to its tabbed name. The asterisk disappears once the unsaved changes have been saved.

[Image of tabbed window with Plot1* highlighted]
The Plot1 tab has unsaved changes, indicated by the (*) asterisk. The Sheet1 and Sheet2 tabs do not have unsaved changes.

Tab Style
The style of the tab can be changed in File | Options | User Interface. Select a new tab style from the MDI tab style list.

No Tabs
Tabs can be turned off in Options dialog User Interface page. Select None from the MDI tab style list.

Changing the Layout
The plot, worksheet, grid editor, or 3D view window, Properties window, Contents window, and ribbon display in a docked view by default. However, they can also be displayed as floating windows. The visibility, size, and position of each item may also be changed.

Visibility
Use the View | Show/Hide commands to toggle the display of the rulers, drawing grid, status bar, Contents window, and Properties window. Alternatively, click the [X] or [X] buttons in the Contents and Properties windows to auto-hide or close the windows.

Right-click the ribbon or quick access toolbar to minimize the ribbon, move the quick access toolbar above or below the ribbon, and customize the ribbon or quick access toolbar.

Auto-Hiding the Contents or Properties Windows
Click the [X] button to auto-hide a docked Contents or Properties window. The window slides to the side of the Surfer main window and a tab appears with the window name.

[Image of Contents tab]
The Contents appears as a tab on the side of the window.
Position the mouse pointer over the tab to view the window. Move your mouse away from the window and the window "hides" again. You can also click inside the window to anchor it at its current position. Click in another window to release the anchor and hide the window. Click the button to return the window to a docked position.

Size
You can drag the sides of the application window, Contents window, Properties window, or document window to change its size. If a window is docked, its left and right bounds are indicated by a cursor, and its upper and lower bounds are indicated by a cursor. Click and drag the cursor to change the size.

Position
To change the position of a docked window, click the title bar and drag it to a new location. To dock the Contents or Properties windows, use the docking mechanism. You can also double-click the window's title bar to toggle between floating and docked modes. Left-click the title bar of a window and drag it to a new location while holding the left mouse button. The docking mechanism displays with arrow indicators as you move the window.

The docking mechanism makes it easy to position the Contents and Properties windows.

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 window to be docked in the specified location.
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This image displays the **Properties** window being docked to the right side of the **Surfer** plot window.

Restoring the Windows to Their Original Locations
If the **Contents** or **Properties** windows have moved or become invisible, or if they are in undesired locations, you can use the View | Windows | Reset Windows command to move them back to their original locations. You must restart **Surfer** for the changes to take effect.

Contents
The **Contents** window contains a hierarchical list of all objects in the plot, grid editor, or 3D view window. The objects can be selected, arranged, moved, renamed, or deleted in the **Contents** window. Changes made in the **Contents** window are reflected in the plot, grid editor, or 3D view window and vice versa.
Displaying or Hiding the Contents Window

The **Contents** window is opened and closed with the View | Show/Hide | Contents command. Clear the Contents check box to hide the Contents window. Check the Contents check box to display the Contents window. Alternatively, you can click on the button in the title bar of the Contents window to close the window. You can also right-click on the Contents window title bar and click Hide. To activate the Contents window, click inside the Contents window or press ALT+F11 on the keyboard.

Auto Hide the Contents Window

You can increase the plot document space by minimizing the Contents window with the **Auto Hide** feature. To hide the manager, click on the button in the upper right corner of the Contents window. The window hides on the left, top, or right side of the plot window as a small tab labeled Contents.

To view the contents of the Contents window while in tab view, place the cursor directly over the tab. Click in the window to keep it open for use. Click outside the window to return it to the hidden position. Click on the button to return it to the normal display mode. Alternatively, right-click the Contents window title bar and select **Auto Hide**. You can also drag the sides the Contents window to change the size of the window.

Changing the Contents Window Location - Floating vs. Docking

The **Contents** window can be docked on the edge of the Surfer window or floated as a dialog. The Contents window is displayed in a docked view by default. The manager can also be detached to display as a floating window. Double-click on the Contents window title bar to toggle between floating and docked modes. Alternatively, right-click the Contents window title bar and select **Floating**, **Docking**, **Auto Hide**, or **Hide**.

To change the position of the docked Contents window, left-click the title bar of the manager and drag it to a new location while holding the left mouse button. The docking mechanism displays with arrow indicators as you move the window. 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.
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Object Tree
If an object contains sub-objects, a ▶ or ▼ is located to the left of the object name. Click on the ▶ or ▼ button to expand or collapse the list. For example, a map object normally contains at least one map layer (e.g. Contours) and four axes. The Map object may contain many other objects. To expand the Map tree, click on the ▶ control. You can also 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 ▼ control. You can also select the item, and press the MINUS key on the numeric keypad or press the LEFT ARROW key. The expansion state of sub-objects in the Contents window is retained in the Surfer file .SRF. Use the Expand new Contents window items option in the Options dialog to control the expansion state of new objects in Contents window.

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 pointer changes to a black 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. Alternatively, select an object and use the Bring to Front, Send to Back, Bring Forward, and Send Backward commands. These commands can be accessed in the Layout | Arrange command group or by right-clicking on an object in the Contents window.
Moving Features
Features such as points, polylines, and polygons can be moved between base (vector) layers and the plot document. The Move/Copy to Layer command can be used to move or copy features. Features can also be moved in the Contents window. To move a feature to another base (vector) layer, select the feature and drag it to a new position within another base (vector) layer. To move a feature to the plot document, select the feature and drag it to a new position above, between, or below the top-level objects in the Contents window.

Object Visibility
Each object in the Contents window includes an icon indicating the type of object and a text label for the object. All objects also have a check box that indicates if the object is visible. A check mark indicates the object is visible. A box indicates the object is not visible. Click on the check box to change the visibility state of the object. Invisible objects do not appear in the plot window and do not appear on printed output. The visibility check box also controls the visibility for all its sub-objects. For example, if a Map object is made invisible the axes and layers within the Map will also be hidden. Note that if a surface is made invisible, any overlays also become invisible.

Locked Objects
Objects and layers can be locked to prevent changes to their size and position with the Lock Position command. When an object or layer is locked, a small lock icon appears in the lower-right corner of the visibility check box. When a map, group, or base layer object is locked, all its sub-objects are automatically locked.
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The lock icon indicates the object is locked. In this example a polygon and base map layer are locked.

Opening Object Properties
To display the properties for an object, click once on the object in the Contents window or in the plot window. The properties are displayed in the Properties window. To display a context menu of available actions for an object, right-click on that object. When the Properties window is hidden or closed, double-clicking on an object in the Contents window opens the Properties window with the properties for the selected object displayed. The map properties control the map’s View, Scale, Limits, Frame, and Coordinate System. Each map layer has specific properties that controls the options for the specific map type. Each map axis also has properties.

Selecting Objects
To select an item in the Contents window, click on the item or press the arrow keys, and the object text is highlighted. The selection handles in the plot change to indicate the selected item. If you select an object in the plot window, its name is selected in the Contents window as well. Only one nested object can be selected at a time. For example, it is not possible to select two axes at once.

To select multiple objects at the same level in the tree, hold down the CTRL key and click on each object. To select multiple contiguous objects at the same level in the tree, select the first object, and then hold down the SHIFT key and click on the last object.
Renaming Objects
To edit an object's text ID, select the object in the Contents window and then click again on the selected item (two slow clicks) to edit the text ID associated with an object. You must allow enough time between the two clicks so it is not interpreted as a double-click. Enter the new name into the box. Alternatively, you can right-click on an object name and select Rename Object, select the object and click the Rename command, or select the object and press F2 on the keyboard. Enter an ID in the Rename Object dialog and click OK.

Deleting Objects
To delete an object, select the object and press the DELETE key. To move a map layer from one map to a new map, click on the map layer and click Map Tools | Layer Tools | Break Apart. Alternatively, right-click on the map layer and select Break Apart Layer.

Scroll the Contents Window
If the list of objects in the Contents window is long, you can use the scroll bar on the side of the Contents window to scroll down to an object. Alternatively, you can use the mouse scroll wheel to scroll down. To scroll down using the mouse, click once in the Contents window to select the window. Roll the mouse wheel backward to scroll lower in the Contents window. Roll the mouse wheel forward to scroll higher in the Contents window.

Properties
The Properties window allows you to edit the properties of a selected object, such as a contour map or axis. The Properties window contains a list of all properties for the selected object. The Properties window can be left open so that the properties of the selected object are always visible.

To display the properties for an object, click once on the object in the Contents window or in the plot window. The properties are displayed in the Properties window. When the Properties window is hidden or closed, double-clicking on an object in the Contents window opens the Properties window with the properties for the selected object displayed. To activate the Properties window, click inside the Properties window or press ALT+ENTER on the keyboard.

For information on a specific feature or property that is shown in the Properties window, refer to the help page for that Properties window page. For instance, if you are interested in determining how to set the Fill colors for a contour map or how to save data for a post map, refer to the contour map Levels help topic or post map General help topic respectively.

Opening and Closing the Properties Window
The Properties window is opened and closed with the View | Show/Hide | Properties command. Clear the Properties check box to close the Properties window. Check the Properties check box to open the Contents window. Alternatively, you can click on the button in the title bar of the Properties window to close the window. You can also right-click on the Properties window title bar and click Hide. To activate the Properties window, click inside the Properties window or press ALT+ENTER on the keyboard.

Auto Hide the Properties Window
You can increase the plot document space by minimizing the Properties window with the Auto Hide feature. To hide the Properties window, click on the button in the upper right corner of the Properties window.
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Click on the autohide button to display the Properties window as a tab.

The window hides on the left, top, or right side of the plot window as a small tab labeled Properties.

The Properties tab view.

To view the contents of the Properties window while in tab view, place the cursor directly over the tab. Click in the window to keep it open for use. Click outside the window to return it to the hidden position. Click on the button to return it to the docked display mode. Alternatively, right-click the Properties title bar and click Auto Hide. You can also drag the sides of the Properties window to change the size of the window.

Changing the Properties Window Location - Floating vs. Docking

The Properties window can be docked on the edge of the Surfer window or floated as a dialog. The Properties window is displayed in a docked view by default. The window can also be detached to display as a floating window. Double-click on the Properties window title bar to toggle between floating and docked modes. Alternatively, right-click the Properties window title bar and select Floating, Docking, Auto Hide, or Hide.

To change the position of the docked Properties window, left-click the title bar of the window and drag it to a new location while holding the left mouse button. The docking mechanism displays with arrow indicators as you move the window. 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.
Changing Properties

The Properties window displays the properties associated with the selected object.

The Properties window displays the properties for selected objects. To change a property, click on the property's value and select a new property from the pop up box, scroll to a new number using the buttons, select a new value using the slider, select a new value from the list or palette, or type a property value. Objects in the plot, grid editor, or 3D view window automatically update after you select an item from a palette, use one of the controls, or press ENTER after typing a new value.

For example, a polyline has Style, Color, Opacity, Width, and End Styles properties. Changing the Color requires clicking on the current color and selecting a new color from the color palette. Changing the Width requires highlighting the current width and typing a new number or scrolling to a new number. Changing the Opacity requires highlighting the current value and typing a new number or clicking on the slider bar and dragging it to a new value.

You can modify more than one object at a time. Only shared properties can be changed are when multiple objects are selected. For example, you can click on a polyline in the Contents window. Hold the CTRL key and click on a polygon. You can then change the line properties of both objects at the same time. Fill properties, which are available if only a polygon is selected, are not available as the polyline does not have fill properties.

Some properties are dependent on your other selections. For example, there is a Pattern Offset section on the Fill page. This section is only available when an image fill type is selected as the Pattern.
Expand and Collapse Features
Features with multiple options appear with a △ or □ to the left of the name. To expand a group, click on the △ icon. To collapse the group, click on the □ icon. For example, the expanded Filled Contours section in the Levels page contains three options, Fill contours, Fill colors, and Color scale.

Keyboard Commands
To activate the Properties window, press ALT+ENTER on the keyboard. When working with the Properties window, the up and down arrow keys move up and down in the Properties window list. The TAB key activates the highlighted property. The RIGHT ARROW key expands collapsed sections, e.g., Filled Contours, and the LEFT ARROW collapses the section.

Property Defaults
Use the File | Options command to change the default settings. Default settings for rulers, drawing grid, line, fill, text, symbol, label format, and advanced settings that control each map type can be set from the Options dialog.

Property Information Area
If the Show property info area is checked on the Options dialog User Interface page, a short help statement for each selected command in the Properties window.

Status Bar
The status bar is located at the bottom of the Surfer window. The status bar displays information about the current command or activity in Surfer. Click the View | Show/Hide | Status Bar check box to show or hide the status bar. A check mark next to Status Bar indicates that the status bar is displayed. Clear the Status Bar check box to hide the status bar.

Status Bar Sections
The status bar is divided into five sections. The left section displays information about the selected command or item in the Properties window. The second section shows the selected object name or the number of objects/points in the selection. The middle section shows the cursor coordinates in map units, if the cursor is placed above a map. The fourth section shows the cursor coordinates in page units of inches or centimeters. The right section displays the dimensions of the selected object. In the worksheet, the status bar displays tool tips.

Grid Editor Status Bar Sections
When viewing a grid in the grid editor, the first three sections of the status bar display a description for the selected property in the Properties window, the active grid node grid coordinates, and the map coordinates of the cursor location.

Adjust Section Width
The status bar section widths can be adjusted to display additional text. If "..." is displayed at the end of the text, additional text can be displayed. To change the width, place the cursor over a section division. When the cursor changes to a ⬇️, left-click and drag the divider left or right to a new location.
Progress
The **Progress** dialog indicates the progress of a procedure, such as gridding. The percent of completion and time remaining will be displayed. Click **Cancel** to stop the current process.

When the program does not know how much time is required to complete a task, the **Indeterminate** mode is displayed in the *Progress* dialog. This indicates that the program is actively completing the task, with an unknown time of completion. The program is not frozen.

Menu and Tab Commands
The ribbon contains the commands that allow you to add, edit, and control the objects on the plot, worksheet, grid editor, or 3D view window page.

Plot Document Commands
When viewing a plot document, the main ribbon tab commands are available:

<table>
<thead>
<tr>
<th>Tab</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>File</strong></td>
<td>Open and save files, import or export data, print, and set options and defaults</td>
</tr>
<tr>
<td><strong>Home</strong></td>
<td>Contains common editing, selection, feature, grid, and map commands</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Layout</th>
<th>Set the page display and arrange or position maps and objects in the plot document</th>
</tr>
</thead>
<tbody>
<tr>
<td>Features</td>
<td>Draw features and perform geoprocessing</td>
</tr>
<tr>
<td>Grids</td>
<td>Perform grid operations</td>
</tr>
<tr>
<td>Map Tools</td>
<td>Add map layers, and edit or analyze maps and map layers</td>
</tr>
<tr>
<td>View</td>
<td>Controls the display of toolbars, status bar, rulers, grids, and managers, resets window positions, tracks cursor between map and worksheet, and controls the zoom level of the plot</td>
</tr>
</tbody>
</table>

Point Cloud Commands
The commands for editing the points within a point cloud layer are located in the Point Cloud tab. The Point Cloud tab is only displayed when a point cloud layer is selected.

| Point Cloud            | Contains commands for selecting, classifying, modifying, and exporting points       |

3D View Commands
The commands for changing the view, creating fly-throughs, and copying images in the 3D view window are located in the 3D View tab. The 3D View tab is only displayed while viewing a map in the 3D view.

| 3D View                | Contains commands for modifying the 3D view, creating a fly-through, and copying an image of the 3D view to the clipboard. |

Worksheet Commands
The primary commands when viewing a worksheet window are located on the Data tab. However, many of the File menu and Grid tab commands are also available when viewing a worksheet window, and a few of the Home and View tab commands are available as well.

| Data                   | Contains commands to sort data, filter data, compute statistics, assign projection, reproject data, and calculate mathematical transformations |

Grid Editor Commands
The primary commands when viewing a grid in the grid editor are located on the Grid Editor tab. The Grid Editor tab includes commands and tools for editing the grid values.

| Grid Editor            | Contains commands to open, edit, and save grids                                   |

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

Worksheet Document
Worksheet windows are a view of the data file and are designed to display, edit, enter, and save data. The worksheet windows have several useful and powerful editing, transformation, and statistical operations available. In addition, a coordinate system can be assigned to the data file. Several import and export options are available for opening data files from other spreadsheet programs. The components of the worksheet window are displayed below.

Worksheet Commands
The worksheet commands include commands on the following tabs:

<p>| File                    | Open and save files, import or export data, print, and set options and defaults    |</p>
<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>Contains clipboard and undo commands</td>
</tr>
<tr>
<td>Grids</td>
<td>Perform grid operations</td>
</tr>
<tr>
<td>View</td>
<td>Controls the display of status bar and windows and resets window positions</td>
</tr>
<tr>
<td>Data</td>
<td>Edit, find, format data in the worksheet. Manipulate, transform, and perform calculations with worksheet data. Assign or project coordinates. Track the cursor between the plot, worksheet, and grid windows.</td>
</tr>
</tbody>
</table>

Not all of the **File**, **Home**, **Grids**, and **View** commands are available in the worksheet view.

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 node editor 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.

**Worksheet Window**
The image below displays the parts of the worksheet document.
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This is the *Surfer* worksheet document with the *Contents* and *Properties* windows in auto hide mode on the left, and the plot document and worksheet tabs at the top of the worksheet.

Grid Editor

The *File | Open, Grids | Editor | Grid Editor*, and *Map Tools | Edit Layer | Grid* commands open the grid editor as a new document.

- The *File | Open* command opens the grid editor when a grid or image file is selected in the *Open* dialog.
- The *Grids | Editor | Grid Editor* command opens a grid file with the *Open Grid* dialog.
- The *Map Tools | Edit Layer | Grid* command opens the grid file from the selected map layer in the plot document. You can also edit the grid for a map layer by right-clicking on the map layer and clicking *Edit Grid*. This command enables the *Update Layer* command in the grid editor. The *Map Tools | Edit Layer | Grid* command is not available for 1-grid vector and 2-grid vector layers.

The grid editor contains various methods for editing the grid Z values. Editing the grid Z values will change the appearance of any grid-based maps. For example, the grid editor can be used to edit contours on a contour map or change the surface in a 3D surface map.

Each grid node is indicated with a black "+" in the grid editor window by default. Each NoData grid node is indicated with a blue "x" by default. The active node is highlighted with a red diamond. To move between grid nodes, press the arrow keys, or click a node with the *Select* tool active to make it the active node. The grid editor also includes contours, node labels, and a color fill. The grid appearance is controlled by the items in the *Contents* window and the properties displayed in the *Properties* window. Note the *Undo* command does not undo changes in the *Properties* window in the grid editor.

Images in the Grid Editor

The grid editor also allows you to open an image file and save as a grid file. A grid requires a single floating point value at each grid node. Images contain colors which are three separate values (Red, Green, Blue) at each pixel.

Color Image

Color image formats are converted to a single floating point value by calculating the intensity of each color value using the intensity equation:

\[ I = A(0.30R + 0.59G + 0.11B) \]

where \( I \) = intensity, \( R, G, B, A \) are the normalized red, green, blue, and alpha.

For example, a pixel from a color image with Red=255, Green=0, and Blue=0 would be mapped to a grid node with the value of:

\[ I = 0.30\times1.0 + 0.59\times0.0 + 0.11\times0.0 = 0.3 \]

Note the normalization process converted the color's (0 to 255) range to (0.0 to 1.0).

Grayscale Image

Grayscale images are imported directly. Grayscale images have a single color value and do not need to use the intensity equation. *Surfer* does not normalize the grayscale value. The value is used exactly as specified in the image.

For example, consider a grayscale image with a pixel that contains a value of 55. The grid node value would be set to 55.
Grid Editor Window
The following image and table explain the purpose of the grid editor window components.

![Surfer grid editor with contents and properties windows on the left and grid editor window on the right.](image)

<table>
<thead>
<tr>
<th>Component Name</th>
<th>Component Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ribbon</strong></td>
<td>The ribbon contains the Grid Editor commands.</td>
</tr>
<tr>
<td><strong>Contents</strong></td>
<td>Toggle the display of the Node Labels, Node Symbols, Contours, and Color Fill with the Contents window.</td>
</tr>
<tr>
<td><strong>Properties</strong></td>
<td>Edit Node Labels, Node Symbols, Contours, and Color Fill display properties in the Properties window.</td>
</tr>
<tr>
<td><strong>Tabbed Documents</strong></td>
<td>Plot windows, worksheet windows, and grid editor windows are displayed as tabbed documents.</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Tool Options</th>
<th>The tool options bar contains the Z value box, Brush size, Density, and/or Pressure depending on the selected tool mode.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Node</td>
<td>The node that is currently selected. The active node is highlighted with a red diamond.</td>
</tr>
<tr>
<td>Grid Node</td>
<td>Each grid node is indicated with a black &quot;+&quot; in the grid editor window by default. NoData nodes are indicated with a blue &quot;x&quot;.</td>
</tr>
<tr>
<td>Status Bar</td>
<td>The status bar includes information about the selected property, active node grid coordinates, and cursor map coordinates.</td>
</tr>
</tbody>
</table>

Grid Editor Commands
The Grid Editor ribbon tab includes the following commands:

- **Select**: Select a grid node to edit the grid Z values one node at a time
- **Brush**: Apply a specific Z value to one or more nodes
- **Warp**: Drag grid values from one region into another
- **Smooth**: Apply weighted averaging to grid nodes
- **Push Down**: Decrease grid node values
- **Pull Up**: Increase grid node values
- **Eraser**: Assign the NoData value to grid nodes
- **Eyedropper**: Acquire a grid node value by clicking on the grid
- **Undo**: Undo the last operation
- **Redo**: Redo the last undone operation
- **Fit to Window**: Fits the entire grid in the grid editor window
- **Zoom In**: Increase the grid editor window magnification
- **Zoom Out**: Decrease the grid editor window magnification
- **Zoom Rectangle**: Zoom in to an area of interest
- **Grid Info**: Display information about the grid in a report window
- **Track Cursor**: Track cursor location across plot, worksheet, and grid editor windows for maps, data files, and grids.
- **Update Layer**: Updates the associated map layer with the edited grid

Using the Grid Editor
The grid editor can be used on existing map layers or on grid files without first creating a map.

To edit a map layer's grid
1. Select the map layer you wish to edit in the plot document Contents window. Only the grid for this map layer will be edited, even when multiple layers use the same grid file.
2. Click Map Tools | Edit Layer | Grid in the plot window. The grid file is opened and is represented by a filled contour map. The location of each grid node in the file is marked with a black "+". NoData nodes are marked with a blue "x".
3. Use the Grid Editor | Tools commands to make the desired adjustments to the grid.
4. When you are done editing the grid, click the Grid Editor | Options | Update Layer command to update the map layer in the plot document with your grid.
5. Click the plot document tab to view the changes to the map layer. If you wish to revert the changes to the map layer, click the Undo command while viewing the plot window. If you are satisfied with the changes to the map layer, you may wish to save the edited grid to a file.
6. If you wish to save your edits to a file, click File | Save As to create a new grid file. Click File | Save to overwrite the existing grid file. It is necessary to save your edits to a file with Save or Save As if you wish to update all layers in your map to use the edited grid.
7. To close the grid editor window, click the **File | Close** command or click the X in the grid editor document tab. To view an existing window and keep the grid editor window open, click on another document tab.

**To edit a grid file**

1. Click the **Grids | Editor | Grid Editor** command and select the grid file in the **Open Grid** dialog. Alternatively, click the **File | Open** command and select a grid file in the **Open** dialog. The grid file is opened and is represented by a filled contour map. The location of each grid node in the file is marked with a black "+". NoData nodes are marked with a blue "x".
2. Use the **Grid Editor | Tools** commands to make the desired adjustments to the grid.
3. When you are done editing the grid, click **File | Save As** to create a new grid file. Click **File | Save** to overwrite the existing grid file. It is necessary to save your edited grid to a file with **Save** or **Save As** if you wish to create map layers with the grid.
4. To close the grid editor window, click the **File | Close** command or click the X in the grid editor document tab. To view an existing window and keep the grid editor window open, click on another document tab.

**File Types**

**Surfer** uses four basic file types: data, grid, base map, and **Surfer** .SRF files.

**Data Files**

Data files are used to produce grid files, post data points on a map, or generate a residuals log. These files are generally referred to as XYZ data files or data files throughout the help. Data can be read from various file types. Most data files contain numeric XY location coordinates and optional Z values. The Z values contain the variable to be modeled, such as elevation, concentration, rainfall, or similar types of values.

XYZ data files contain raw data that **Surfer** interprets to produce a grid file. To create a grid file, you must start with an XYZ data file. XYZ data files are organized in column and row format. **Surfer** requires the X, Y, and Z data to be in three separate columns.

**Grid Files**

Grid files produce several different types of grid-based maps, are used to perform grid calculations, and to carry out grid operations. Grid files are a regularly spaced rectangular array of Z values in columns and rows. Grid files can be created in **Surfer** using the **Home | Grid Data | Grid Data** command or can be imported from a wide variety of sources such as WCS servers or other applications.

**Base Map Files**

Base map files contain XY location data such as aerial photography, state boundaries, rivers, or point locations. Base map files can be used to create layers overlaid on other map types, or to specify the limits for assigning NoData values, faults, breaklines, or slice calculations. Base map files can be created from a wide variety of vector and image formats or can imported from online WMS, OSM, or WFS servers. Base map files may be referred to as vector data files, raster data files, and images or image files in the help, depending on the type of data in the base map file.

**Surfer Files**

**Surfer** .SRF files preserve all the objects and object settings contained in a plot window. These files are called **Surfer** .SRF files throughout the documentation. **Surfer 16** can open .SRF files from previous **Surfer** versions v7 through v15. **Surfer 16** can save files in **Surfer 11**, **Surfer 12**, **Surfer 13**, **Surfer 14**, and **Surfer 15** .SRF format. For example, the **Surfer 15 Plot .SRF** file type can be opened in **Surfer 15** or **Surfer 16**, but does not contain features that are new in **Surfer 16**. Previous versions of **Surfer** (e.g. **Surfer 15**) cannot open **Surfer 16**.SRF files. Beginning with **Surfer 16**, the **Surfer Plot (*.srf**) file type will be backwards compatible with all **Surfer** versions 16 and newer.
Gridding Overview
A grid is a rectangular region comprised of evenly spaced rows and columns. The intersection of a row and column is called a grid node. Rows contain grid nodes with the same Y coordinate. Columns contain grid nodes with the same X coordinate. Contour, color relief, grid values, vector, viewshed, watershed, 3D surface, and 3D wireframe map layers all require grids in Surfer.

What is Gridding?
Gridding is the process of taking irregularly spaced XYZ data and generating a regularly spaced grid of Z values at each grid node by interpolating or extrapolating the data values. In addition to gridding data, Surfer can also use a variety of other grid files directly. For a list of these, refer to the File Format Chart in the online help.

Gridding Methods
Gridding the data produces a regularly spaced, rectangular array of Z values from irregularly spaced XYZ data. The term "irregularly spaced" means that the distance between data points varies in the X or Y direction, or both. Irregularly spaced data often has many holes where data are missing. Gridding fills in these holes by extrapolating or interpolating Z values at those locations where no data exists. The gridding method determines the mathematical algorithms used to compute the Z value at each grid node. Each method results in a different representation of your data. It is advantageous to test each method with a typical data set to determine the gridding method that provides you with the most satisfying interpretation of your data.

When your XYZ data is regularly spaced, meaning the distance between data points does not change in the X and Y directions, you may produce a grid file that uses the Z values directly and does not interpolate values for the grid nodes. See the Producing a grid file from a regular array of XYZ data help topic for more information.

General Gridding Options
Each gridding method has its own set of gridding options. Some of the options are the same or similar for the different gridding methods, while other options are specific to particular gridding methods. Some options that are available to multiple gridding methods include: Search, Anisotropy, Breaklines, and Faults.

Grids Tab Commands
There are many ways to manipulate grid files in Surfer. The Grids tab contains commands used to assign the NoData value, convert, create, extract, filter, mosaic, slice, smooth, and transform grid files. In addition, volume calculations, variogram generation, calculus operations, cross section creation, and residual calculations can be performed using the commands under the Grids tab.

<table>
<thead>
<tr>
<th>Data</th>
<th>Create a grid from irregularly spaced XYZ data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid from Server</td>
<td>Create a grid from downloaded DEM data</td>
</tr>
<tr>
<td>Grid from Contours</td>
<td>Create a grid from contour lines</td>
</tr>
<tr>
<td>Function</td>
<td>Create a grid from a user-specified function</td>
</tr>
<tr>
<td>Variogram</td>
<td>Create a new variogram and export a variogram</td>
</tr>
<tr>
<td>Assign NoData</td>
<td>Assign NoData to grid nodes inside or outside a boundary</td>
</tr>
<tr>
<td>Filter</td>
<td>Filter an existing grid by applying a moving matrix filter</td>
</tr>
<tr>
<td>Convert</td>
<td>Convert between various grid formats</td>
</tr>
<tr>
<td>Spline Smooth</td>
<td>Smooth an existing grid using cubic splines</td>
</tr>
<tr>
<td>Assign Coordinate System</td>
<td>Assign the coordinate system of a grid file and save the information to an external file</td>
</tr>
<tr>
<td>Function</td>
<td>Description</td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
</tr>
<tr>
<td><strong>Project</strong></td>
<td>Create a grid in a different coordinate system</td>
</tr>
<tr>
<td><strong>Calculus</strong></td>
<td>Perform calculus operations on an existing grid file</td>
</tr>
<tr>
<td><strong>Volume</strong></td>
<td>Compute the volume under or over a grid surface</td>
</tr>
<tr>
<td><strong>Math</strong></td>
<td>Provide grid-to-grid and grid-to-constant math operations</td>
</tr>
<tr>
<td><strong>Transform</strong></td>
<td>Scale, offset, mirror, or rotate an existing grid file</td>
</tr>
<tr>
<td><strong>Slice</strong></td>
<td>Compute a cross section of data through a grid surface</td>
</tr>
<tr>
<td><strong>Residuals</strong></td>
<td>Compute the difference between XYZ data and a grid surface</td>
</tr>
<tr>
<td><strong>Point Sample</strong></td>
<td>Compute the Z value at specified XY locations on the grid surface</td>
</tr>
<tr>
<td><strong>Mosaic</strong></td>
<td>Combine a series of compatible input grids into a single output grid</td>
</tr>
<tr>
<td><strong>Extract</strong></td>
<td>Extract a subset of a grid from an existing grid file</td>
</tr>
<tr>
<td><strong>Grid Editor</strong></td>
<td>Change the values of nodes in a grid or edit the grid with various tools</td>
</tr>
<tr>
<td><strong>Grid Info</strong></td>
<td>Display information about the grid</td>
</tr>
</tbody>
</table>

**Map Types**

Several different map types can be created, modified, and displayed with Surfer. These map types include base, contour, post, classed post, 3D surface, 3D wireframe, color relief, grid values, watershed, 1-grid vector, 2-grid vector, and point cloud maps. Viewshed layers can be added to existing maps. A brief description and example of each map is listed below.

**Base Map**

Base maps display boundaries on a map and can contain polygons, polylines, points, text, images, or metafiles. Base maps can be overlaid with other map layers to provide details such as roads, buildings, streams, city locations, areas of no data, and so on. Base maps can be produced from vector files, images, and data files. Individual base map objects can be edited, moved, reshaped, or deleted. Symbology can be added to a base map to communicate statistical information about the map features. Empty base maps can be created and used for drawing objects on other maps. Raster (image) and vector base maps can be downloaded from online WMS, OSM, and WFS mapping servers.

**Contour Map**

Contour maps are two-dimensional representations of three-dimensional data. Contours define lines of equal Z values across the map extents. The shape of the surface is shown by the contour lines. Contour maps can display the contour lines and colors or patterns between the contour lines. Contours can be linearly spaced, logarithmically spaced, spaced with an equal area for each contour interval, or a custom spacing can be set between each set of lines.
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Post Map

Post maps and classed post maps show data locations on a map. You can customize the symbols and text associated with each data location on the map. Each location can have multiple labels. Classed post maps allow you to specify classes and change symbol properties for each class. Classes can be saved and loaded for future maps.

The post map layer has black symbols. The classed post map layer has red circles and blue squares. Only a sample of the data set is displayed in the classed post map.

3D Surface Map

3D surface maps are color three-dimensional representations of a grid file. The colors, lighting, overlays, and mesh can be altered on a surface. Multiple 3D surface maps can be layered to create a block diagram.

This is a 3D surface map of the Telluride, Colorado USGS SDTS grid file.

3D Wireframe Map

3D wireframe maps are three-dimensional representations of a grid file. Wireframes are created by connecting Z values along lines of constant X and Y.

This is a 3D wireframe map with a custom rotation, tilt, and field of view.

Color Relief Map

Color relief maps are raster images based on grid files. Color relief maps assign colors based on Z values from a grid file. NoData regions on the color relief map are shown as a separate color or as a transparent fill. Pixels can be interpolated to create a smooth image. Hill shading or reflectance shading can be applied to the color relief map to enhance its depth and appearance.

This is a color relief map of the colorado.grd sample file.
Grid Values Map

**Grid values maps** show symbols and labels at grid node locations across the map. The density of the labels and symbols is controlled in the X and Y directions independently. Symbol color can vary by value across a colormap, and symbols and labels can be displayed for only a specific range of values. Grid lines can be added to the map.

This is a watershed map of a USGS SDTS grid file.

Watershed Map

**Watershed maps** display the direction that water flows across the grid. The watershed map breaks the grid into drainage basins and streams. Colors can be assigned to the basins and line properties can be associated with the streams. In addition, depressions can be removed by filling the depression.

Vector Map

1-grid and 2-grid vector maps display direction and magnitude data using individually oriented arrows. At any grid node on the map, the arrow points in the downhill direction of the steepest descent and the arrow length is proportional to the slope magnitude. Vector maps can be created using information in one grid file (i.e. a numerically computed gradient) or two different grid files (i.e. each grid giving a component of the vectors).

This is a 1-grid vector map of Colorado elevations.

Point Cloud Map

**Point cloud maps** display LAS/LAZ data as points at XY locations. LAS/LAZ data can be combined from multiple files and filtered with various criteria when creating a point cloud map. Color is assigned to the points by elevation, intensity, return number, or classification. Surfer includes commands for modifying, classifying, and exporting points in a point cloud layer. A grid can be created from the point cloud layer. Point cloud layers are displayed in the 3D View as three-dimensional points.

This is a point cloud of the Golden, CO area from USGS Elevation Source Data.
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Viewshed Layer

Viewshed layers highlight the regions of a map that are visible (or invisible) from a transmitter location. The transmitter, receiver, and obstruction height above the surface can be specified. The viewshed analysis radius and angle can also be specified. Viewsheds can be added to any 2D grid based map. A viewshed can also be added to a 3D surface map that is displayed with no tilt (90 degrees) and in the orthographic view.

Map Wizard

Click the Home | Wizard | Map Wizard command to create a map with the Map Wizard. The Map Wizard steps through the map creation process from raw data to a map with one or more layers. If necessary, data is gridded to create a grid-based map layers.

The Map Wizard consists of two or three pages, depending on the input data type. Click the following links for more information on each of the wizard pages.

1. Select Your Data - Select the data, boundary, or grid file you wish to use to create your map.
2. Select Your Map Type - Select one or more map layer types and decide to create a new map or place the new layers in an existing map.
3. Select Gridding Parameters - Create a grid file if you selected a data file and a grid-based layer in the first two steps.

A map is created, or layers are added to a map, in the plot window after proceeding through the Map Wizard.

Map Wizard - Select Your Data

Click the Home | Wizard | Map Wizard command to open the Map Wizard. The first page is the Select Your Data page. Here you select the data, grid, boundary, or image file you wish to use to create your map. Once you have selected your data source, click Next to proceed to the Select Your Map Type page.
Specify the data file and coordinate columns or grid file you wish to use to create a map.

Select File
Select your data, grid, vector, or image file in the Select File list. The Select File list includes a list of Recent files, Sample files, Project files, or files in a folder you select with Browse. To change the Select File list, click the current selection at the top of the list and select Recent files, Sample files, Project files, or Browse.

Recent Files
When Recent files is selected in the Select File list, the most recently opened files are displayed in the Select File list. By default the number of files in the Recent files list is 10. Change the number of files in the Recent files list in the Options dialog User Interface page.

Sample Files
When Sample files is selected in the Select File list, the sample files included with Surfer are displayed in the Select File list.

Project Files
When Project files is selected in the Select File list, the files located in the user defined project folder are displayed in the Select File list. The Project folder option can be set in the Options dialog on the General page or in the Welcome to Surfer dialog.
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Browse
Select Browse in the Select File list to open a file with the Open dialog. After you select a file in the Open dialog, the file preview is loaded in the Select Your Data page and the folder contents are visible in the Select Files list.

Data Preview
The Data Preview section contains a preview of the selected file. Check the Show preview check box to see a preview of the selected data, grid, or boundary file. When a file is selected in the Select File list, the file is loaded and a preview is displayed. The Surfer status bar displays the loading progress for large data files.
- Data files are displayed in a table.
- Grid files are displayed as a color relief map.
- Boundary files are displayed as a base map.
Clear the Show preview check box to hide the preview.

Select Data Columns
When a data file is selected in the Select File list, the Select Data Columns section is displayed. Specify the columns that contain the X, Y, and Z data in the Select Data Columns table. The Coordinate column indicates the row for the X, Y, and Z selections. The Column column includes the column letter and, if a header row is present, the column header. To change a selection, click the column you wish to changed and select the desired column from the list.

Next and Cancel
Click Next to proceed to the Select Your Map Type page. Click Cancel to close the Map Wizard without creating a map.

Map Wizard - Select Your Map Type
Click the Home | Wizard | Map Wizard command to open the Map Wizard. The second page is the Select Your Map Type page. Here you select the layer types you would like to create in your map and whether to create a new map or add the layers to an existing map. Click Next to proceed to the Select Gridding Parameters or click Finish to create your map. Which button is displayed depends on your selections in the Select Your Data and Select Your Map Type pages.
Specify the layer types you wish to create and select whether to create a new map or add the layer(s) to an existing map.

Add Layer To
The Add layer to option determines if the new map layer or layers will be added to a new map or an existing map. A new map is created by default. Select [New Map] to create a new map in the plot document. Alternatively, click the Add layer to field and select an existing map from the list to add the layers to an existing map.

Map Types
Select the desired layer types by clicking the map type. A check mark indicates a map layer will be included. Click on a selected layer type to clear the check box. A lock indicates the map type is not compatible with the source file selected on the Select Your Data page.

- Data files can be used to create any of the map layer types: Base, Contour, Post, Classed Post, Color Relief, 3D Surface, 3D Wireframe, Watershed, 1-Grid Vector, and Grid Values.
- Grid files can be used to create the grid-based map layers: Contour, Color Relief, 3D Surface, 3D Wireframe, Watershed, 1-Grid Vector, and Grid Values.
- Boundary files can only be used to create a Base map. Try the Home | New Map | Base command to quickly create base maps without the Map Wizard.

The 3D wireframe layer type cannot be overlaid with a 3D surface or color relief layer. When a new selection cannot overlay with a previous selection, the previous selection is cleared.
Creating Grid Based Maps from Data Files
When a data file is selected on the Select Your Data page and a grid-based layer is selected on the Select Your Map Type page, a grid must be created before creating the map. The Finish button changes to Next. Click Next to proceed to the Select Gridding Parameters page and create the grid.

When the data source is a grid file or boundary file, the map can be created by clicking Finish.

Description
The Description section includes a brief explanation of the map type, as well as which data types are used to create the layer type and any conflicts with other layer types.

Back, Finish, Next, or Cancel
Click Back to return to the Select Your Data page if you wish to change the data source. Click Finish to create your map. When gridding is necessary, click Next to proceed to the Select Gridding Parameters page. Click Cancel to close the Map Wizard without creating a map.

Map Wizard - Select Gridding Parameters
Click the Home | Wizard | Map Wizard command to open the Map Wizard. The third page is the Select Gridding Parameters page. Here you specify the gridding parameters for creating the grid for the grid-based layer or layers. Once you have specified the gridding parameters, click Finish to create your grid file and map.
Specify gridding parameters for creating a grid from the source data file.

Simple Gridding Parameters
Select *Simple gridding parameters* to quickly generate a grid with the default gridding options. When *Simple gridding parameters* is selected, specify the Gridding method and output grid geometry.

Gridding Method
*Surfer* has several different gridding methods. These gridding methods define the way in which the XYZ data are interpolated when producing a grid file. Change the *Gridding method* by clicking the current selection and selecting the desired method from the list. Refer to the gridding methods for more information on the options.

Output Grid Geometry
The *Output Grid Geometry* section defines the grid limits and grid density. The *Output Grid Geometry* section also controls whether grid nodes outside the data are automatically assigned the NoData value. See the Grid Data topic for a grid geometry example.

Copy Geometry
The *Copy geometry from* option copies the grid geometry from an existing map layer or grid file. This option is useful when creating grids that will become overlaid map layers, processed with the Grid.
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**Math** command, or used to calculate a **volume** between two surfaces. The **Math** and **Volume** commands require the input grids to have the same geometry.

To copy the geometry from an existing layer, select the layer in the **Copy geometry from** list. To copy the geometry from a grid file, click **Browse** and select the file in the **Open Grid** dialog. Select **<None>** to return the **Output Grid Geometry** options to their default values.

The **Copy geometry from** option displays **<Custom>** when the **Minimum**, **Maximum**, **Spacing**, or **# of Nodes** values have been manually edited. Select **<None>** to return the **Output Grid Geometry** options to their default values. Select a layer or file to copy the grid geometry.

**Minimum and Maximum X and Y Coordinate (Grid Limits)**
Grid limits are the minimum and maximum X and Y coordinates for the grid. **Surfer** computes the minimum and maximum X and Y values from the XYZ data file. These values are used as the default minimum and maximum coordinates for the grid.

Grid limits define the X and Y extent of contour maps, color relief maps, vector maps, 3D wireframes, and 3D surfaces created from grid files. When creating a grid file, you can set the grid limits to the X and Y extents you want to use for your map. Once a grid file is created, you cannot produce a grid-based map larger than the extent of the grid file. If you find you need larger grid limits, you must regrid the data. You can, however, read in a subset of the grid file to produce a map smaller than the extent of the grid file.

When either the X, Y, or Z value is in a **date/time format**, the date/time values are converted and stored in the grid as numbers.

**Spacing and # of Nodes (Grid Density)**
Grid density is usually defined by the number of columns and rows in the grid, and is a measure of the number of grid nodes in the grid. The **# of Nodes** in the **X Direction** is the number of grid columns, and the **# of Nodes** in the **Y Direction** is the number of grid rows. The direction (**X Direction** or **Y Direction**) that covers the greater extent (the greater number of data units) is assigned 100 grid nodes by default. The number of grid nodes in the other direction is computed so that the grid nodes **Spacing** in the two directions are as close to one another as possible.

By defining the grid limits and the number of rows and columns, the **Spacing** values are automatically determined as the distance in data units between adjacent rows and adjacent columns.

**Assign NoData Outside Convex Hull**
Check the box next to the **Assign NoData outside convex hull of data** to automatically assign the NoData value to the grid nodes outside the convex hull of the data. Leave the box unchecked to extrapolate the data to the minimum and maximum grid limits, regardless of whether data exists in these areas.

**Output Grid File**
Choose a path and file name for the grid file in the **Output grid file** option. You can type a path and file name, or click the **Save Grid As** button to browse to a new path and enter a file name in the **Save Grid As** dialog.

**Advanced Gridding Parameters**
Select **Advanced gridding parameters** for full control over the gridding method, advanced options, and grid geometry. After selecting **Advanced gridding parameters**, click the **Advanced Gridding Parameters** button to set the gridding options in the **Grid Data** dialog. See the **Grid Data** topic for more information on the advanced gridding parameters.
Introduction to Map Layers

A map layer is a single map type contained in a larger map object. The map layer may be a contour layer, a post layer, a base layer, or any other layer type that Surfer can create. The larger map object contains all the individual map layers and axes used to create the entire map. Map layers can be created as separate maps or added to a single map object.

It is possible to combine several maps created from related data to create one map object with multiple map layers. You can add any combination and number of contour, base, post, color relief, vector, watershed, viewshed, or 3D surface layers to a single map. However, a map can contain only one 3D wireframe layer.

There are multiple ways to overlay map layers in Surfer. If you have multiple maps and wish to move only one layer, you can drag a map layer from one map object to another map object in the Contents window. If you wish to combine all the layers from multiple maps, you can select all the maps and use the Map Tools | Map Tools | Overlay Maps command. This moves all the map layers to a single map object. If you have already created a map and need to add map layers to it, you can select the map and use one of the Home | Add to Map | Layer commands to add a map layer to the existing map.

Using Map Layers

When you use map layers, the layers use a single set of X, Y, and Z axes and the maps are positioned according to the map object coordinate system. If two or more maps use the same limits, they will overlay on top of one another. If maps cover adjacent areas, adding a map layer places them in the correct position relative to one another and creates a single set of axes that span the entire range. Layered maps become a single object and are moved and scaled as a single entity.

Consider a contour map and a base map that displays the outline of a lake on the contour map. The limits of the base map are the X, Y extents of the lake and are not the same as the contour map limits. If you create both the base map and the contour map in a single plot window as separate maps by using the Home | New Map commands for both maps, they do not overlay correctly because the maps have different scaling. In addition, each map uses a different set of X, Y axes. The two maps can be overlaid to correctly position the lake on the contour map by dragging the base map layer to the other map object that has the contour layer. The result will be a map object with a base map layer...
and contour map layer. Alternatively, if you create the contour map and then added a base map layer with the **Home | Add to Map | Layer | Base** command, the two maps are automatically scaled and combined into a single map using a single set of axes. The lake is correctly positioned on the contour map.

**Layers and 3D Wireframes**

When you layer a contour, post, or base map on a **3D wireframe**, the maps are draped over the wireframe. The wireframe is drawn in the usual fashion but the base, vector, or contour maps are "molded" over the top of the wireframe lines. Hidden lines are not removed from maps layered on wireframes. For example, contour lines are not hidden when the contour map lies over a wireframe.

**Layers and 3D Surfaces**

When you layer maps on top of **3D surface** maps, hidden lines are removed and the maps are "molded" on the surface. Surface maps and **images**, vector files, and even other surface maps can be overlaid onto a single map object. The **Overlays** page in the surface properties dialog contains options for handling color in these cases.

**Layer Exceptions**

The **Map Tools | Add to Map | Layer** commands add a map layer to the selected map. Most combinations of map types can be layered. The exceptions are combining a 3D wireframe and 3D surface map, adding a raster map layer or **point cloud** to a wireframe, and adding multiple wireframe layers. Raster maps include **color relief maps**, surfaces, and **base maps** containing an image. The options under the **Add** command change to fit the existing map. For example, if a 3D wireframe map is selected, the **Map Tools | Add to Map | Layer | 3D Surface** command is grayed out.

**Method 1: Adding a Map Layer to an Existing Map Frame**

1. Create a new map with a **Home | New Map** command. For example, you can choose **Home | New Map | Contour** to create a contour map.
2. Select the map and click the **Map Tools | Add to Map | Layer** command to add a map layer. Select the map layer type to add to your existing map. For example, select the contour map and use the **Map Tools | Add to Map | Post** command to add a post map layer to the contour map.
3. The maps are combined in the correct position based on their coordinates and limits. For example, in the **Contents** window, you will see one map object with a contour map layer and a post map layer.

**Method 2: Overlaying Two Existing Maps**

1. Create a new map with a **Home | New Map** command. For example, you can choose **Home | New Map | Contour** to create a contour map.
2. Create a second map with the **Home | New Map** command. You could create a post map with the **Home | New Map | Post | Post** command.
3. Note that each map has an independent set of axes.
4. Click **Home | Selection | Select All** to select both the contour and post maps.
5. Click **Map Tools | Map Tools | Overlay Maps**. The two maps are combined onto a single map object with a single set of axes. The empty map object is automatically deleted.

This method works well when you have multiple map layers that you want to combine.

**Method 3: Combining Two Existing Maps in the Contents Window**

If two maps already exist, you can move (or overlay) a map layer from one map frame into the other map frame by dragging and dropping in the **Contents** window.

1. Create a new map with a **Home | New Map** command. For example, you can choose **Home | New Map | Contour** to create a contour map.
2. Create a second map with the **Home | New Map** command. You could create a post map with the **Home | New Map | Post | Post** command.
3. Note that each map has an independent set of axes.

The contour map layer and the post map layer are displayed in separate map objects in the Contents window and the plot window.

2. Select the post map layer in the Contents window and drag it to the contour map object. To do this, left-click and hold the left mouse button while you drag the map layer to a new map frame. When the cursor changes to a horizontal arrow, release the left mouse button and the map layer is added to the contour map's map frame. The post map will now be overlaid on the contour map. An empty map frame may remain after removing the last map layer from the map object, depending on your options.

First left-click and select the post map layer (left), then drag the post map layer to the other map object. When the cursor is a horizontal arrow (middle), release the mouse button to drop the map layer in the new location (right).

3. If an empty map frame exists, select the empty map frame and press DELETE on the keyboard to remove the empty map frame. The end result is a single map object with two map layers: a post map layer and a contour map layer. Additional map layers can be added with the Map Tools | Add to Map commands.
Layer Map Limits
If a map layer is added to a map frame and the map layer exceeds the current map limits, a **Surfer** warning message will be displayed allowing you to adjust the map limits to include all layers. Select Yes to adjust the map to include all layers. Select No to leave the current map limits.

Editing a Map Layer
To edit individual layers in a multi-layer map, select the map layer (i.e. **Contours**) in the plot window or **Contents** window and use the **Properties** window to edit the properties. Make the desired changes in the map layer properties, and the map layer is redrawn with the specified changes.

Hiding a Map Layer
After adding map layers, it is possible to hide one or more of the layers. To temporarily hide a map layer, uncheck the visibility box next to the map layer name (i.e. **Contours**) in the **Contents** window. The map is redrawn without the selected overlay. To make the overlay visible again, recheck the visibility box. Note that if a surface is made invisible, the overlays are also made invisible.

Removing a Map Layer
Select the map layer and use the **Break Apart Layer** command to remove a map layer from a map object. Alternatively, right-click on the map layer and select **Break Apart Layer**.

Deleting a Map Layer
To delete a map layer from a map frame, select the map layer in the **Contents** window and press the DELETE key on the keyboard. Alternatively, you can select the map layer and use the **Home | Clipboard | Delete** command, or right-click the map layer and select **Delete**.

Coordinate Systems
A coordinate system is method of defining how a file's point locations display on a map. Different types of coordinate systems exist that control how the coordinates are shown on the map. In **Surfer**, a map can be unreferenced in local coordinates, referenced to a geographic latitude and longitude coordinate system, or referenced to a known projection and datum. Each data set, grid, map layer, and the map frame can have an associated coordinate system. All coordinate systems for individual layers are converted "on the fly" to the map's target coordinate system. This allows maps with different coordinate systems to be easily combined in **Surfer**.
A local coordinate system generally is considered unreferenced. A local system has a location that begins numbering at an arbitrary location and increments numbers from this location. This is frequently referred to as a **Cartesian coordinate system**. The distance units can be specified for an unreferenced local system in the **Assign Coordinate System** dialog.

A **Geographic** coordinate system uses a spherical surface to define locations on the earth. Geographic coordinate systems are commonly called **unprojected lat/long**. **Surfer** has several predefined geographic coordinate systems available. Each system has a different **datum**. The same latitude and longitude value will plot in different locations depending on the datum.

A **Projected** coordinate system consists of a **projection** and a **datum**. Each projection distorts some portion of the map, based on the **ellipsoid** and datum specified. Coordinates can be lat/long, meters, feet, or other units. Different projections cause different types of distortion. It is recommended that you do not use projected coordinate systems if you do not need to convert between coordinate systems or if all your data are in the same coordinate system.

**Map Coordinate System Overview**

In **Surfer**, data, grids, map layers, and maps can have an associated coordinate system. All coordinate systems defined by the data, grids, and map layers are converted "on the fly" to the map's **target coordinate system**. This allows maps with different coordinate systems to be easily combined in **Surfer**.

The standard procedure for creating maps in a specific coordinate system is as follows:

1. Create the map by clicking on the appropriate **Home | New Map** command.
2. Click on the map layer to select it.
3. In the **Properties** window, click on the **Coordinate System** tab.
4. If the **Coordinate system** is not correct, click the **Set** button next to **Coordinate System**. The **Assign Coordinate System** dialog opens. This is the initial coordinate system for the map layer, i.e. the coordinate system for the source data. Select the correct coordinate system in the dialog. When finished making changes, click **OK**.
5. To change the target coordinate system for the map, click on the **Map** object in the **Contents** window. In the **Properties** window, click on the **Coordinate System** tab. This is the coordinate system in which you want the map to display.
6. Click on the **Change** button next to **Coordinate System** to set the desired **target coordinate system**. When finished, click **OK**.
7. All the map layers are converted on the fly to the target coordinate system. The entire map is now displayed in the desired coordinate system.

**Surfer** does not require a map projection be defined. Maps can be created from unreferenced data, grid, and map layers. As long as all map layers have the same X and Y ranges, coordinate systems do not need to be specified. If you do not specify a source coordinate system for each map layer, it is highly recommended that you do not change the target coordinate system. Changes to the target coordinate system for the map can cause the unreferenced map layers to appear incorrectly or to not appear.

3D **surface maps** and **wireframe maps** cannot be converted to a new coordinate system.

**File Menu Commands**

The **File** menu in the plot document has the following commands:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>Creates a <strong>new plot</strong> window or <strong>new worksheet</strong> window</td>
</tr>
<tr>
<td>Open</td>
<td>Opens a file in a plot document, worksheet, or grid node editor</td>
</tr>
<tr>
<td>Close</td>
<td>Closes the active document</td>
</tr>
<tr>
<td>Close All</td>
<td>Closes all open documents</td>
</tr>
</tbody>
</table>
Save  Saves the active document
Save As  Saves the active document window to a new file name or location
Import  Imports vector or graphics files
Export  Exports vector or graphics files
Reload Map Data  Reloads external data used to generate maps
Page Setup  Set the page options for the plot, or set the page and printing options for the worksheet
Print  Prints the active plot document or worksheet
Options  Set Surfer options and default properties in the plot window
Defaults  Set advanced default settings
Customize Ribbon  Customize the ribbon, quick access toolbar, and keyboard commands
Online  Check for Update or open the Golden Software Home Page, Surfer Product Page, or Frequently Asked Questions
Feedback  Send a Problem Report, Suggestion, or Information Request
Recent Documents  Open a recent plot, worksheet, or grid file
License Info  Activate a product key, connect to a license server, or view license information
About Surfer  View version information, system information, and contact information
Exit  Closes Surfer

New Plot
You can create a new plot document or worksheet with the File | New command. Click the File | New command, or click the button in the Quick Access Toolbar, to create a new plot document. Maps are created in a plot document.

New Worksheet
You can create a new plot document or worksheet with the File | New command. The worksheet document is used to manage data. Click the File | New | Worksheet command, or click the button in the Quick Access Toolbar, to create a new worksheet window.

Open
The File | Open command opens a file into a new window. A Surfer file .SRF opens in a plot document, a grid file .GRD opens into the grid editor, and data files open in the worksheet. You can also click on the button on the Quick Access Toolbar, or press CTRL + O on the keyboard to open files.

Open Dialog
Use the File | Open command in the plot document, worksheet document, or grid node editor to open the Open dialog.
Select the file to open in the **Open** 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 *Golden Software 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, or type a path and file name into the box to open a file.

**Specify a File Type**
The *Files of type* field shows the file format to be opened. To change the file format, click the down arrow and select the file type from the list. *All Files (*.*)* display all files in a directory.

The *Common Document Files (*.*)* format type is selected by default. This displays all the common file formats in the navigation pane. If a different format type is selected, **Surfer** will remember the
setting until the end of the current session. When **Surfer** 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 shows all of the file formats even if the file type is not appropriate for the action chosen (i.e. displaying a data file when creating a grid based map that requires a grid file).

**Surfer** files open in the Plot Document, data files open in the **Worksheet Document**, and grid files open in the **Grid Node Editor**.

**Import Database**
Click the **Database** button in the **Open** dialog to open the **Data Link Properties** dialog and import a database.

**File Types**

**Surfer** files open in a new plot window. These are .SRF files.


**Data Link Properties**
You can open database files in **Surfer** by clicking **Database** in the **Open** and **Open Data** dialogs or **Load Database** in the **Import Data** dialog. The **Data Link Properties** dialog will open. Imported databases appear in a new worksheet window. Once the worksheet is saved, the link to the database is removed.

The data linking provides a method to link virtually any database supported by Microsoft via an OLE DB Provider, ODBC, or some other supported format. Because the data link provides access to many types of databases that vary by computer, and since this link is provided by Microsoft, only general information is provided here. Click **Help** in the **Data Link Properties** dialog to access Microsoft’s help file for this dialog. If you need additional information on specific connection information, contact your network administrator.

**ODBC Drivers**
Note that ODBC drivers are installed by the database program, not by **Surfer**. If a database program is not installed on the computer, a driver may still be able to be located to import the data from the database. For example, the Microsoft Access database engine can be downloaded from [Microsoft’s website](https://www.microsoft.com).

**Data Link Properties Dialog**
Data linking is used to define links to many types of databases. The **Data Link Properties** dialog is accessed by clicking the **Database** button in the **Open** or **Open Data** dialogs or the **Load Database** button in the **Import Data** dialogs. The **Open** dialog appears when you use the **File | Open** command. The **Import Data** dialog appears when you use the worksheet **File | Import** command. The **Open Data** dialog appears when you use the **Grid Data, New Variogram, Classed Post Map, or Post Map** command.
Use the Data Link Properties dialog to define links to a database.

Help Button
Click the Help button in the Data Link Properties dialog to access Microsoft's help file for this dialog. If you need additional information on specific connection information, contact your network administrator.

Data Linking
To use data linking,
1. Click the File | Open command or one of the other commands listed above.
2. Click Database in the Open and Open Data dialogs or Load Database in the Import Data dialog.
3. The Data Link Properties dialog opens, with the Provider tab active.
4. Step through the dialogs to import the database data.

Provider Tab
Use the Provider tab to select the appropriate OLE DB provider for the type of data you want to access. Not all applications allow you to specify a provider or modify the current selection; this tab is displayed only if your application allows the OLE DB provider selection to be edited. You can save a data link with the application itself or as a separate file. For more information about creating a data link, refer to the Microsoft help.

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</tr>
</thead>
</table>
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<table>
<thead>
<tr>
<th>OLE DB Provider(s)</th>
<th>Lists all OLE DB providers detected on your computer. For more information about providers, see &quot;Microsoft OLE DB Providers Overview&quot; in the MDAC SDK.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next</td>
<td>Opens the Connection tab for the selected OLE DB provider.</td>
</tr>
</tbody>
</table>

Note   You can navigate directly to the **Connection** tab by double-clicking the desired provider. For more information about Data Links, see the [Data Link API Reference](#).

Click **Next** or click the **Connection** tab to specify how to connect to ODBC data.

**Connection Tab**
This **Connection** tab is provider-specific and displays only the connection properties that are required by the Microsoft OLE DB Provider for ODBC.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use data source name</td>
<td>Select from the list, or type the ODBC data source name (DSN) you want to access. You can add more sources through the ODBC Data Source Administrator. Refresh the list by clicking Refresh.</td>
</tr>
<tr>
<td>Use connection string</td>
<td>Allows you to type or build an ODBC connection string instead of using an existing DSN.</td>
</tr>
<tr>
<td>Build</td>
<td>Opens the Select Data Source dialog box. Once you select a data source the connection string in that data source will appear in the Connection tab of the Data Link Properties dialog. If you select a File DSN, the resulting ODBC connection string is not based on a DSN. The ODBC connection string is persisted in the data link (.udl) file and does not rely on the selected file DSN. If you select a Machine DSN, the resulting ODBC connection string is based on a DSN. The ODBC connection string references the selected machine DSN. If a user on a different system attempts to access the data link (.udl) file, the user must also have the machine DSN installed.</td>
</tr>
<tr>
<td>User name</td>
<td>Type the User ID to use for authentication when you log on to the data source.</td>
</tr>
<tr>
<td>Password</td>
<td>Type the password to use for authentication when you log on to the data source.</td>
</tr>
<tr>
<td>Blank password</td>
<td>Enables the specified provider to return a blank password in the connection string.</td>
</tr>
<tr>
<td>Allow saving password</td>
<td>Allows the password to be saved with the connection string. Whether the password is included in the connection string depends on the functionality of the calling application. Note   If saved, the password is returned and saved unmasked and unencrypted.</td>
</tr>
<tr>
<td>Enter the initial catalog to use</td>
<td>Type in the name of the catalog (or database), or select from the drop-down list.</td>
</tr>
<tr>
<td>Test Connection</td>
<td>Click to attempt a connection to the specified data source. If the connection fails, ensure that the settings are correct. For example, spelling errors and case sensitivity can cause failed connections.</td>
</tr>
</tbody>
</table>

Note: For more Data Link connection information, see the [Data Link API Reference](#).

**Advanced Tab**
Use the **Advanced** tab to view and set other initialization properties for your data.
The **Advanced** tab of the **Data Link Properties** dialog box is provider-specific and displays only the initialization properties required by the selected OLE DB provider. For more information about advanced initialization properties, see the documentation provided with each specific OLE DB provider.

The following table describes most initialization options.

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
</table>
| Impersonation level     | The level of impersonation that the server is allowed to use when impersonating the client. This property applies only to network connections other than Remote Procedure Call (RPC) connections; these impersonation levels are similar to those provided by RPCs. The values of this property correspond directly to the levels of impersonation that can be specified for authenticated RPC connections, but can be applied to connections other than authenticated RPCs. Select from the following levels:  
  - **Anonymous**—The client is anonymous to the server. The server process cannot obtain identification information about the client and cannot impersonate the client.  
  - **Delegate**—The process can impersonate the client's security context while acting on behalf of the client. The server process can also make outgoing calls to other servers while acting on behalf of the client.  
  - **Identify**—The server can obtain the client's identity. The server can impersonate the client for Access Control List (ACL) checking but cannot access system objects as the client.  
  - **Impersonate**—The server process can impersonate the client's security context while acting on behalf of the client. This information is obtained when the connection is established, not on every call. |
| Protection level        | The level of data protection sent between client and server. This property applies only to network connections other than RPC connections; these protection levels are similar to those provided by RPCs. The values of this property correspond directly to the levels of protection that can be specified for authenticated RPC connections, but can be applied to connections other than authenticated RPCs. Select from the following levels:  
  - **Call**—Authenticates the source of the data at the beginning of each request from the client to the server.  
  - **Connect**—Authenticates only when the client establishes the connection with the server.  
  - **None**—Performs no authentication of data sent to the server.  
  - **Pkt**—Authenticates that all data received is from the client.  
  - **Pkt Integrity**—Authenticates that all data received is from the client and that it has not been changed in transit.  
  - **Pkt Privacy**—Authenticates that all data received is from the client, that it has not been changed in transit, and protects the privacy of the data by encrypting it. |
| Connect timeout         | Specifies the amount of time (in seconds) that the OLE DB provider waits for initialization to complete. If initialization times out, an error is returned and the connection is not created. |
| Access permissions      | Select one or more of the following permissions:  
  - **Read** - Read only.  
  - **ReadWrite** - Read and write. |
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- **Share Deny None** - Neither read nor write access can be denied to others.
- **Share Deny Read** - Prevents others from opening in read mode.
- **Share Deny Write** - Prevents others from opening in write mode.
- **Share Exclusive** - Prevents others from opening in read/write mode.
- **Write** - Write only.

Note: For more Data Link initialization information, see the [Data Link API Reference](#).

**All Tab**
Use the All tab to view and edit all OLE DB initialization properties available for your OLE DB provider. Properties can vary depending on the OLE DB provider you are using. For more information about the initialization properties, refer to the documentation provided with each specific OLE DB provider.

<table>
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<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initialization props</td>
<td>Lists all properties and their current values.</td>
</tr>
<tr>
<td>Edit Value</td>
<td>Opens the Edit Property Value dialog box for the selected property.</td>
</tr>
</tbody>
</table>

Note: You can open the **Edit Property Value** dialog box by double-clicking the desired property. For more Data Link initialization information, see the [Data Link API Reference](#).

**Close**
Clicking the **File | Close** command, right-clicking on a document tab and selecting **Close**, or clicking the X next to the tab name closes the active window. If you have not saved the current changes, you are prompted to save changes before the window closes.

Specify if you would like changes saved in the **Surfer** dialog.

**Yes**
Click **Yes** to save changes and then close the window. If the file has not been previously saved the **Save As** dialog appears.

**No**
Click **No** to close the document without saving changes.
Cancel
Click Cancel to return to the active document window.

Close All
Click the File | Close All command to close all plot, worksheet, and grid documents in Surfer without exiting the application. You are prompted to save or discard any changes in each document before the window closes.

Click the application control close button or File | Exit to close all documents and exit Surfer.

Yes
Click Yes to save changes and then close the window. If the file has not been previously saved the Save As dialog appears.

No
Click No to close the document without saving changes.

Cancel
Click Cancel to return to the active document window.

Save
The File | Save command writes information to disk using the current file name and type. You can also click the button on the quick access toolbar to save a file. If the file has not yet been saved, the Save As dialog is displayed so you can give the file a name and select the file type. If you would like to save an existing file to a new file name or change the file type, choose File | Save As instead of File | Save.

In the plot document, the Save command saves information in the Surfer .SRF file format that is not recognized by other applications. When you want to use Surfer information in other applications, you can use the File | Export command to create files in several useful formats.

Use Caution when Saving Excel Files!
A file can be saved in an Excel format from Surfer, but only one worksheet can be saved. Surfer does not allow for saving multiple worksheets in a single Excel document. If a multi-worksheet Excel document is opened and saved as an .XLS file from Surfer, be aware that only the single worksheet will be saved in the document. All the unused worksheets will be lost. In this case, a warning message is issued.
File Names, Formats, and File Extensions
When a worksheet file is saved, the file format can be specified by typing the appropriate extension on the file name. If the needed file is an ASCII DAT file, type a file name such as MYDATA.DAT. The ".DAT" extension tells the worksheet to save the file as an ASCII DAT file.

If the extension is not included in the file name the format is determined by the Save as type field. For example, if the name MYDATA is typed into the file name field and the Save as type field is set to Excel Spreadsheet (*.XLS), the file is saved as MYDATA.XLS in Excel format.

The file can be saved with any extension by enclosing the file name in double quotes. The file is saved with the name and extension typed in the file name box, but it is saved in the format specified in the Save as type field. For example, type the name (with quotes) " MYDATA.ABC" in the file name box. If the Save as type field is set to Comma Separated Variables (*. csv), the file is saved as MYDATA.ABC in the .CSV format.

Surfer Files
Surfer .SRF files preserve all the objects and object settings contained in a plot window. These files are called Surfer .SRF files throughout the documentation. Surfer 16 can open .SRF files from previous Surfer versions v7 through v15. Surfer 16 can save files in Surfer 11, Surfer 12, Surfer 13, Surfer 14, and Surfer 15 .SRF format. For example, the Surfer 15 Plot .SRF file type can be opened in Surfer 15 or Surfer 16, but does not contain features that are new in Surfer 16. Previous versions of Surfer (e.g. Surfer 15) cannot open Surfer 16 .SRF files. Beginning with Surfer 16, the Surfer Plot (*.srf) file type will be backwards compatible with all Surfer versions 16 and newer.

Save As
The File | Save As command saves a new document or saves a modified document with a new file name. The File | Save As command in the plot document and worksheet document opens the Save As dialog. The File | Save As command in the grid editor opens the Save Grid As dialog.

Save As Dialog
The Save As dialog is displayed when saving a document with the File | Save As command.
Specify the save location, file name, and file type in the **Save As** dialog. This graphic may look different, depending on the operating system.

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

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

**File List**
The **File list** displays the files using the extension specified in the **Save as type** box. A file can be overwritten by selecting it from the file list.

**File Name**
The **File name** box displays the name of the selected file, or type in the path and file name of the file to be saved.
Save As Type
Select the file format in the Save as type list.

File Types
The available file types to save as or export depend on the location from you are exporting.

- Save Surfer files SRF in the Plot Document with File | Save As. Surfer Plot (*.srf) files created in Surfer 16 can only be opened in Surfer 16 and later versions. The Surfer Plot (*.srf) file type will be backward compatible with every Surfer version back to Surfer 16 as new versions are released. In the future, it will not be necessary to save back to a specific file version unless you wish to open the file in Surfer 15 or older versions.

- Save version-specific backward compatible Surfer files for versions prior to Surfer 16 by selecting Surfer 11 Plot (*.srf), Surfer 12 Plot (*.srf), Surfer 13 Plot (*.srf), Surfer 14 Plot (*.srf), and Surfer 15 Plot (*.srf) files can be opened in previous versions of Surfer. For example Surfer 11 Plot (*.srf) files can be opened by Surfer 11 and newer versions. New features are removed from the file when saving in a previous Surfer version format.

- Save BLN, BNA, CSV, DAT, TXT, SLK, XLS, XLSX files in the Worksheet Document with File | Save As.

File Names, Formats, and File Extensions
When a worksheet file is saved, the file format can be specified by typing the appropriate extension on the file name. If the needed file is an ASCII DAT file, type a file name such as MYDATA.DAT. The "DAT" extension tells the worksheet to save the file as an ASCII DAT file.

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Check for Update
Click the File | Online | Check for Update command to check for the most recent version of Surfer. If there is an update available (e.g. Surfer 16.0 to Surfer 16.1), you can follow the directions to download and install the free update. An update contains minor changes to the program. Normally, no new features are added in updates. See the Golden Software website version information page for a list of changes. Surfer can be updated to the latest minor version (e.g. 15.x) regardless of maintenance status.

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 any difficulties with the update, please contact technical support.
Automatic Update

**Surfer** automatically checks for updates once every seven days by default. This preference can be adjusted at any time using the **File | Options** command. Automatic updates allow the program to periodically check for an available update. Enabling automatic updates will allow your copy of **Surfer** to always automatically stay up-to-date.

Check for Internet Update

- Click the **File | Online | Check for Update** command, the **Internet Update** dialog appears. If you are running in Windows 7 as a user, a dialog appears asking for Administrator permissions. Click the **Allow** button.
- Click the **Next** button to proceed. **Surfer** 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 **Surfer**. Click the **OK** button and the **Internet Update** dialog will close.
- If an update is available, the dialog will inform you about the specifics of the update. Click **Next** to download the update file. A progress gauge displays. If you choose not to download the update at this time, click **Cancel**. It is highly advised that updates be installed when available as updates contain corrections to known issues in the software.
- When the download is complete, the **Install Updates** dialog will appear.
- Save any changes to your work and exit the **Surfer** program by clicking the **File | Exit** command. Click **Install** to proceed with the update.
- After the update is installed successfully, you can open **Surfer** and continue working.

Upgrade

If your maintenance license is active, you can upgrade to the next major version (e.g. **Surfer 15** to **Surfer 16**) by clicking the **File | Online | Check for Update** command. If your maintenance has expired and you’d like to renew your maintenance, contact Golden Software.

About Surfer

Use the **File | About Surfer** command to see detailed information about **Surfer**, such as: version number, copyright date, serial number, system information, and Golden Software, LLC contact information.

About Dialog

Use the **File | About Surfer** command to open the **About** dialog.
Surfer Version
The version of Surfer you are currently using is listed in the About dialog. Use the File | Online | Check for Update command to ensure you are running the most recent version of Surfer. Updates (e.g. Surfer 15.0 to Surfer 15.1) are free.

Company Contact Information
The Golden Software mailing address, sales phone number, and technical support phone number are listed in the About dialog. You can also use the File | Feedback commands to contact technical support.

Golden Software Website
Click the link to open the Golden Software website in a new internet browser window.

System Info
Click the System Info button to open the System File Information dialog. Detailed file information (Name, Version, Date, Size) is available for files In Directory, In Memory, or for All system files. You can view the system file information, or copy the information by clicking Copy to Clipboard button.

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.

Find your Surfer version number in the About dialog.
Click on any of the document names listed in the Recent Documents list to open that file.

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.

Exit
Use the File | Exit command to close Surfer. If changes have been made to any open documents there will be a prompt to save the changes.

Welcome to Surfer Dialog
The Welcome to Surfer dialog is displayed when you first start Surfer. The Welcome to Surfer dialog provides immediate access to the File | New | Plot, File | New | Worksheet, and Map Wizard commands, sample files, recent files, project files, and the tutorial. The Welcome to Surfer dialog also displays a tip about using Surfer. Resize the Welcome to Surfer dialog by clicking and dragging any side or corner of the dialog.
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The **Welcome to Surfer** dialog helps you get started quickly in **Surfer**.

**New Plot**
Click the **New Plot** button to start **Surfer** with a **new plot** open in the plot window.

**New Worksheet**
Click the **New Worksheet** button to start **Surfer** with a **new worksheet** open in the **worksheet window**.

**Map Wizard**
Click **Map Wizard** to create a **new plot** and get straight to creating your map with the **Map Wizard**.

**Open Files and File Preview**
The **Files** section of the **Welcome to Surfer** dialog displays **Surfer SRF files** in one of three categories. Click the current selection in the **Files Type** list, and select **Recent Files, Sample Files, or Project Files** to change which files are displayed in the **Files** section. The **Files Type** selection is remembered the next time **Surfer** is started.

Click a file name to see a preview image in the **Welcome to Surfer** dialog. The preview is only available for **Surfer 13** and newer .SRF files. Click on another file or press the UP ARROW or DOWN ARROW keys to change the file selection. Once a file is selected, the **Open** button is enabled. Click the **Open** button to start **Surfer** with the selected file open in the plot window. Alternatively, double-click on a file name to start **Surfer** with the selected file open in the plot window.

If the file you wish to open is not in the **Recent Files, Sample Files, or Project Files** list, select **Browse** in the **Files Type** list. Next, select the file to open in the **Open** dialog.
Recent Files
When Recent Files is selected in the Files Type list, the most recently opened Surfer files are displayed in the Files list. By default the number of files in the Recent Files list is 10. Change the number of files in the Recent Files list in the Options dialog User Interface page.

Sample Files
When Sample Files is selected in the Files Type list, the sample files included with Surfer are displayed in the Files list.

Project Files
When Project Files is selected in the Files Type list, the Surfer files located in the user defined project folder are displayed in the Files list. Change the project folder by clicking the Set Project Folder button and selecting the appropriate folder in the Select Folder dialog. Alternatively, the Project folder option can be set in the Options dialog on the General page. However, if the project folder is set in the Options dialog, Surfer must be closed and reopened for the changes to take effect.

Browse
Select Browse in the Files Type list to open a file with the Open dialog.

Tip
The Tip is a useful statement regarding a Surfer command or process.

Open
Click the Open button to start Surfer with the selected file in the Files list in the plot window. The Open button is enabled when a file is selected in the Files list.

Set Project Folder
Change the project folder by clicking the Set Project Folder button and selecting the appropriate folder in the Select Folder dialog. The Files Type selection is changed to Project Files after changing the project folder. If you click Cancel in the Select Folder dialog, the Files Type selection is not changed.

Tutorials
Click the Tutorials button to open the online help Tutorial Introduction help topic. The tutorial is a useful starting place for users who are new to Surfer.

Hiding the Welcome to Surfer Dialog
Uncheck the Show this dialog at start up check box to start Surfer without displaying the Welcome to Surfer dialog in the future. The Welcome to Surfer dialog can be enabled or disabled by checking or unchecking the Show welcome screen at startup check box in the Options dialog on the User Interface page.

Close
Click the Close button, the button, or press ESC to close the Welcome to Surfer dialog and start Surfer with a new plot in the plot window.

Technical Support
Golden Software’s technical support is free to registered users of Golden Software products. Our technical support staff is trained to help you find answers to your questions quickly and accurately. We are happy to answer all 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 respond to email and fax technical questions within one business day. When contacting us with your question please have the following information available:

- Your Surfer product key
- Your Surfer version number, found in File | About Surfer
- The operating system you are using (Windows 7, 8, 10 or higher)
- The steps taken to produce your problem
- The exact wording of the first error message that appears (if any)

If you cannot find the answer to your question in online help, the quick start guide, or on our web page FAQs, KB, or support forum, please do not hesitate to contact us:

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Register Product Key
Please remember to register your software by filling out the registration form online. Registering your product key entitles you to free technical support, announcements, and training resources. Our database is confidential, and Golden Software will not share or sell your contact information.

To register your product key,
2. Log in to your account.
3. Click Register Software.
4. Fill out the registration form.
5. Click Submit Registration.

Your product key is located in your email download instructions. Please take a minute to register your copy of Surfer with us.

New Features
This is an overview of some of Surfer's new features.

User Friendly
- A new Grid Data Advanced Options dialog includes a scatter plot, search ellipse, and easier to use controls

Map Features
- Contour labels can be drawn along the curved path of the contours
- Generate equal area contour levels
- The new Colormap Editor includes opacity mapping, color stretch by histogram equalization or even distribution, and new interpolation methods
- Display post, classed post, and base (vector) layers as 3D scatterplots in the 3D view window
- The contour map color scale bar can show the line style from the contour levels
- Format numeric base map labels
- The shaded relief map has been combined with the color relief map
- Add geometry attributes to the Attribute Table
- Create new or modify existing attributes by calculating attributes in the Attribute Table

Gridding Features
- The Kriging gridding method now supports Kriging with external drift
• Copy grid geometry from an existing grid when creating a new grid with the Grid Data, Mosaic, Grid from Contours commands or Map Wizard

Drawing and Boundary Editing Features
• Move or copy features to different base layers with a command or by dragging and dropping the feature in the Contents window
• Move, copy, or export features returned by a Query
• Duplicate objects

Import and Export Improvements
• Export DBF files
• Export GPX files
• Import Esri MDB files
• Import GDB files
• Import and export Adobe addendum style GeoPDF files

Automation
• Add and edit a graticule
• Perform queries
• Perform geoprocessing commands: line thinning, line smoothing, buffer, create intersection points, change type, connect polylines, union, intersect, or difference of polygons, break polyline, break polyline at intersections, combine island/lakes, and split island/lakes
• Save the gridding report and grid volume reports to TXT or RTF files

Projections, Coordinate Systems, and Datums
• New Coordinate System: EPSG 2169 (Luxembourg 1930 Gauss)
• New Coordinate Systems: various Australia GDA2020 systems
• New Coordinate Systems: various Africa UTM Zones
• New Datum: GDA2020
Chapter 2 - Tutorial

The tutorial is designed to introduce basic Surfer features and should take less than an hour to complete. After you have completed the tutorial, you will have the skills needed to create maps in Surfer using your own data. The tutorial can be accessed in the program by clicking the button and navigating to the Tutorial book or by clicking Tutorials in the Welcome to Surfer dialog.

If you find you still have questions after you have completed the tutorial, you should consider reviewing the material in Surfer's extensive in-program help. The help is also available on the web. The Golden Software website contains a knowledge base of questions and answers, an interactive forum, and training videos. Usually, the answers to your questions are found in one of these locations. However, if you find you still have questions, do not hesitate to contact Golden Software's technical support team. We are happy to answer your questions before they become problems.

Tutorial Overview

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

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<td>shows you how to begin a new Surfer session and open a new plot window.</td>
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<td>opens and edits an existing data file and creates a new data file.</td>
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<td>Lesson 2 - Using the Map Wizard</td>
<td>creates a grid file, the basis for most map types in Surfer, and a map with contour, post, and color relief layers.</td>
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<td>edits the contour, post, and color relief layer properties.</td>
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<td>creates and edits 3D surface map.</td>
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<td>changes the transparency of various objects, adds a color scale, and adds a map title.</td>
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<td>loads multiple map layers from different coordinate systems and sets the target coordinate system for the entire map.</td>
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Advanced (optional) Lessons

Optional Advanced Tutorial Lessons are available to demonstrate additional features of Surfer.

A Note about the Documentation

Various font styles are used throughout the Surfer quick start guide and online help. Bold text indicates commands, dialog names, tab names, and page names. Italic text indicates items within a dialog or the Contents or Properties windows such as section names, options, and field names. For example, the Save As dialog contains a Save as type list. Bold and italic text may occasionally be used for emphasis.

Also, commands appear as Home | New Map | Contour. This means, "click or scroll to the Home tab at the top of the plot window, then click on the Contour command within the New Map command
group." The first word is always the menu or ribbon tab name, followed by the command group, and finally the command name within the menu list or on the ribbon.

Sample File Location
The sample files used in the tutorial lessons are located in the Surfer SAMPLES folder. The SAMPLES folder is located by default at C:\Program Files\Golden Software\Surfer 16\Samples. Note, if you are running the 32-bit version of Surfer on a 64-bit version of Windows, the SAMPLES folder is located at C:\Program Files (x86)\Golden Software\Surfer 16\Samples, by default.

Starting Surfer
To begin a Surfer session:
1. Navigate to the installation folder, which is C:\Program Files\Golden Software\Surfer 16 by default.
3. The Welcome to Surfer dialog appears. Click New Plot to open a new blank plot window.
4. A new empty plot window opens in Surfer. This is the work area where you can produce grid files, maps, and modify grids.

If this is the first time that you have opened Surfer, you are prompted to license Surfer. 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 Surfer, open a new plot window before starting the tutorial. To open a new plot window, click the File | New | Plot command.

Lesson 1 - Viewing and Creating Data
An XYZ data file is a file containing at least three columns of data values. The first two columns are the X and Y coordinates for the data points. The third column is the Z value assigned to the XY point. Although it is not required, entering the X coordinate in column A, the Y coordinate in column B, and the Z value in column C is a good idea. Surfer looks for these coordinates in these columns by default. You can customize the default columns for XYZ data with the Assign XYZ Columns worksheet command. Surfer requires the use of decimal degree Latitude (Y) and Longitude (X) values when using Latitude and Longitude values.

![A simple XYZ data file. Notice that the X, Y, and Z data are placed in columns A, B, and C, respectively.](image)
Creating a New Data File - Tutorial

The **Surfer** worksheet can also be used to create a new data file. To open a worksheet window and begin entering data:

1. Click the **File | New | Worksheet** command, click the on the quick access toolbar, or press CTRL+W on the keyboard. A new empty worksheet window is displayed.
2. Data is entered into the active cell. The active cell is selected by clicking on the cell or by using the arrow keys to move between cells. The active cell is indicated by a heavy border and the contents of the active cell are displayed in the active cell edit 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.
3. When a cell is active, enter a value or text, and the information is displayed in both the active cell and the active cell edit box.
4. The BACKSPACE and DELETE keys can be used to edit data as you type.
5. To preserve the typed data in the active cell, move to a new cell. Move to a new cell by clicking a new cell with the pointer, pressing one of the arrow keys, or pressing ENTER. Press the ESC key to cancel without entering the data.

---

Opening an Existing Data File - Tutorial

To look at an example of an XYZ data file, you can open any sample data file in a worksheet window:

1. Click the **File | Open** command, click the button on the quick access toolbar, or press CTRL+O on the keyboard to open the **Open** dialog.
2. If you are not in the **Samples** folder, browse to it. By default, the **Samples** folder is located in C:\Program Files\Golden Software\Surfer 16. In the list of files, click **TutorWS.dat**.
3. Click **Open** to display the file in the worksheet window.

Notice that the X coordinate (Easting) is in column A, the Y coordinate (Northing) is in column B, and the Z value (Elevation) is in column C. Although it is not required, row 1 contains header text, which is
helpful in identifying the type of data in the column. When a header row exists, the information in the header row is used in the Properties window when selecting worksheet columns.

Adding New Data - Tutorial

To edit any value, click in the cell to select it. Type information and the existing value is overwritten. Data can be transformed, sorted, or filtered in this window. New columns can be added. For instance, an ID column can be added which labels each row with a unique identifier. To do this,

1. Click in cell D1.
2. Type the text Name.
3. Press ENTER to save the text and move the active cell to cell D2.
4. Click the Data | Data | Transform command.
5. In the Transform dialog, set the Transform with to Column variables (e.g., C = A + B).
6. Set the Transform equation to \( D = "MW" + \text{ITOA}(\text{ROW}() - 1) \). This equation will use a prefix of "MW" before a number. The number is the row number minus 1 for each row. The ITOA function converts the \( \text{ROW}() - 1 \) number to text.
7. Set the First row to 2.
8. Set the Last row to 48 (the last row in the worksheet).
9. Leave the Empty cells, Text cells, and Number cells set to the defaults.
10. Click OK and each row will have a unique identifier.
Set the options in the *Transform* dialog as above to add a unique identifier to each row.

The worksheet should now have a unique identifier column:

The new column contains a unique identifier for each row. This can be used for labels later in the tutorial.

**Saving the Data File - Tutorial**

When you have completed entering all of the data, the file can be saved.
Chapter 2 - Tutorial

1. Click the File | Save As command. The Save As dialog is displayed.
2. Navigate to the folder in which you wish to save the tutorial, for example the Documents folder.
3. In the Save as type list, choose the DAT Data (*.dat) option.
4. Type Tutorial into the File name box.
5. Click the Save button and the Data Export Options dialog opens.
6. Accept the defaults in the Data Export Options dialog by clicking OK.

The file is saved in the Data .DAT format as Tutorial.dat. The name of the data file appears in the title bar and on the worksheet tab.

Lesson 2 - Using the Map Wizard
Now that we have saved the data file, we will use the Map Wizard to create a grid and a map with contour and post layers. The Map Wizard steps through the map creation process from raw data to a map with one or more layers. The Map Wizard is useful for creating multiple map types from a single data file. The Map Wizard can use a data, grid, or boundary file as an input file.

1. If you have the worksheet window open, click on the Plot1 tab above the worksheet window. Alternatively, you can create a new plot window with the File | New | Plot command.
2. Click the Home | Wizard | Map Wizard command.

The Map Wizard opens to the first page, the Select Your Data page. The remaining topics in Lesson 2 will step through the pages of the Map Wizard.

Select Your Data - Tutorial
The first page in the Map Wizard is the Select Your Data page. Here you select the XYZ data, grid, vector data, or image file you wish to use to create your map.
Select the data file from Lesson 1 in the **Select Your Data** page.

1. By default, the **Map Wizard** displays the sample files in the **Select File** list. Click **Sample files** and select **Browse** from the list. The **Open** dialog is displayed. You can also display **Recent files** and **Project files** in the **Select File** list.
2. In the **Open** dialog, navigate to the Tutorial.dat file you saved in *Lesson 1 - Saving the Data File*.
3. Select the **Tutorial.dat** file and click **Open**. The **Tutorial.dat** file is loaded in the **Data Preview** section. The column letters and header row information is displayed in the **Select Data Columns** list. By default the X coordinate is column A, the Y coordinate is column B, and the Z coordinate is column C. Any other valid input files in the folder are also displayed in the **Select File** list.
4. Click **Next** in the **Map Wizard**.

**Select Your Map Type - Tutorial**

Now that you have selected a data file and specified the data columns, we can select which map layers will be included in the map on the **Map Wizard - Select Your Map Type** page.
XYZ data files are the most flexible input file type. All of the layers are available in the Select Your Map Type page after selecting an XYZ data file on the Select Your Data page. Some map types will be unavailable after choosing an image, vector, or grid file on the Select Your Data page. The data file type and the map type selections determine if a map is created after the Select Your Map Type page or if a grid must be created first.

For this tutorial we will include a contour and post layer in our map:
1. Click the Post map in the Map types - check all desired list to select it. Notice a description is displayed in the Description field.
2. Click the Contour map in the Map types - check all desired list to select it. The Finish button changes to Next. This is because we must create a grid from the XYZ data file before we can create a contour map.
3. Click Next.

Select Gridding Parameters - Tutorial
Grid files are required to produce a grid-based map. Grid-based maps include contour, color relief, vector, viewshed, watershed, 3D wireframe, and 3D surface map layers. If necessary, grid files are created with the Map Wizard. Grid files can also be created at any time by using the Home | Grid Data | Grid Data command.
A grid must be created from the Tutorial.dat file to display a contour map. The Map Wizard - Select Gridding Parameters page controls the gridding options and output grid file name. The Select Gridding Parameters page displays a preview color relief map for you to quickly compare gridding methods. We will create a grid with the default gridding method and options.

1. Verify that the Gridding method is set to Kriging. If it is not, click the current gridding method and select Kriging from the list.
2. Verify that the Assign NoData outside convex hull of data option is not checked.
3. Verify that the Output grid file is named Tutorial.grd and in the desired directory, for example your Documents folder. If it is not, click and select the desired path for the created grid file.
4. Click Finish.

The grid is created and saved, and a map is created in the plot window with a contour and post layer. The map uses the default display properties. The Map Wizard is a useful tool for quickly creating maps and grids. However, it is not necessary to use the Map Wizard. Grids can be created with the Grid Data command, and maps and layers can be created with the Home | New Map and Home | Add to Map | Layer commands.

Adding a Color Relief Layer - Tutorial

Map layers allow you to add multiple maps to an existing map to create one map object displaying a variety of map types. The map uses a single set of axes and the map layers are positioned according to the target coordinate system. For example, if you have a contour map of weather data, you can add a post map layer displaying the location and station names of each data collection station.

Multiple map layers can be created at one time when using the Map Wizard. However, map layers can also be added to an existing map by selecting the map and using the Home | Add to Map | Layer command, by dragging an existing map layer from one map object to another, or by selecting all maps and using the Map Tools | Map Tools | Overlay Maps command. Now we will add a color relief layer to the map:

1. Click on the Map object in the Contents window, or click on the map in the plot window, to select it.
2. Click the Home | Add to Map | Layer | Color Relief command. The Open Grid dialog is displayed.
3. Navigate to the Tutorial.grd file you created in Select Gridding Parameters and select it.
4. Click Open to add the color relief layer to the map.
Chapter 2 - Tutorial

Now a color relief layer is also displayed in the map.

The color relief layer is added to the map and uses the default display properties. In Lesson 3, we will edit the appearance of the map by changing the color relief, contour, and post layer properties.

Lesson 3 - Changing Layer Properties
The map's appearance is mainly determined by the properties of the map layers. This lesson will demonstrate a few of the common properties for controlling the display of contour, post, and color relief layers. However, each map type has many properties and display options. A description and explanation is included for every property in the help.

We will begin by changing the color relief layer's colors:

1. Click the Color Relief-Tutorial.grd layer in the Contents window to select it. When multiple layers are overlaid in a single map, it is often easier to select the desired layer in the Contents window. When the color relief layer is selected, the color relief layer properties are displayed in the Properties window.
2. Click the General tab in the Properties window to display the General page.
3. If necessary, click the button next to General to expand the General section.
4. The Colors property determines the colormap used in the color relief map. The default colormap is Terrain. Click Terrain and select Rainbow from the Colors list.
Now the color relief layer is using the *Rainbow* colormap. You can click the ..., next to the *Colors* property to customize the colormap in the Colormap Editor.

**Changing Contour Levels - Tutorial**
You can easily modify any of the contour map features. For example, you might want to change the contour levels displayed on the map.

To change the contour levels:
1. Click on the *Contours-Tutorial.grd* object in the *Contents* window. When the contour layer is selected, the **contour properties** are displayed in the *Properties* window.
2. In the *Properties* window, click the **Levels** tab to display the contour levels and contour line properties for the map. In this example, the contour levels begin at $Z = 20$. This is displayed next to **Minimum contour**. The **Maximum contour** level is $Z = 105$.
3. To change the contour range, click in the box next to **Minimum contour** or **Maximum contour**. Highlight the current value and type a new value. The **Data range** of the grid file is displayed at the top of the Levels page, making selecting an appropriate range easier. For best results, select values for **Minimum contour** and **Maximum contour** that are in or near this **Data range**.
4. The **Contour interval**, or the frequency of contour lines, is five. This means that a contour line will be displayed every five Z units. We should see contour lines at 20, 25, 30, 35, etc. up to 105. Click in the **Contour interval** box, highlight the value 5, and type the value 10.
5. Press ENTER on the keyboard. The map automatically updates to show contour lines every 10 Z units. The minimum contour level is $Z = 20$, and the largest contour level is $Z = 100$. 

![Go to the Levels page to display the contour level properties.](image)
Chapter 2 - Tutorial

The contour map is redrawn using new contour levels based on a contour interval of 10.

Changing Contour Line Properties - Tutorial
You can set any of the options in the list on the Levels page to customize the contour map. The Major contour every value allows the setting of two different line styles, the major and minor contour lines, for the contour map. By default, the major contour lines are black and labeled and the minor contour lines are gray and unlabeled. The number of minor contour lines and the line properties for both the major and minor contours can be changed.

Setting the Major Contour Value
1. Highlight the number in the box next to Major contour every and type in a new value of 3.
2. Press ENTER on the keyboard and every third line is a major contour line.

Changing the Major Contour Line Properties
1. Click the + next to Major Contours, if the section is not already expanded.
2. Click the + next to Line Properties in the Major Contours section. The major line properties appear.
3. Click the Black color box next to Color. Select another color, such as Red, from the list. The map automatically updates.
4. Click the + next to Width and change the value to 0.03 inches. Thick red lines now appear at the major contours.

Changing the Minor Contour Line Properties
1. Click the + next to Minor Contours, if the section is not already expanded.
2. Click the + next to Line Properties in the Minor Contours section. The minor line properties appear.
3. Click the 30% Black color box next to Color. Select another color, such as 80% Black, from the list.
4. Click in the box next to Style and select a dashed line from the list. Dashed gray lines now appear at the minor contours.
Advanced Contour Level Properties - Tutorial

Contour map level properties can be set in one of four methods: Simple, Logarithmic, Equal area, or Advanced. As seen is the previous topic, the Simple method is easy to use and quick to adjust. The Logarithmic method is very similar to the Simple method, but it uses a logarithmic scale rather than a linear scale. The Equal area method creates a number of contour intervals with equal area. When using the Advanced method, each contour line is individually controlled.

Control advanced settings for the Level, Line, Fill, Label, and Hach properties of the contour map in the Levels for Map dialog. Properties can be adjusted for all contours at once by clicking on the column buttons, or for individual contours by double-clicking on the specific contour level.

The changes that can be made by clicking the Levels for Map dialog header buttons include the following:

- Set the minimum, maximum, and contour interval by clicking the Level button.
- Set the line properties for all lines to a uniform or gradational color and style by clicking the Line button.
- Set the colormap for the foreground and background color and the fill pattern between all contour lines by clicking the Fill button.
- Set the label properties for all contour labels or contour labels on a frequency basis by clicking the Label button.
- Set the hachure properties for all contours or on a frequency basis by clicking the Hach button.

Individual level changes that can be made include the following items:

- Set an individual level value by double-clicking on the level value to enter a new Z value.
- Set the individual line properties for a single level by double-clicking the line style for that level.
- Set the fill color or pattern for a single level by double-clicking on the fill pattern for that level.
- Set the label properties for a single contour label by double-clicking on the Yes or No under the Label column for that level.
- Set the hachure properties for a single contour level by double-clicking on the Yes or No under the Hach column for that level.

Now we will apply the Advanced level method and customize the contour levels with some bulk changes:

1. In the Contents window, click once on the Contours-Tutorial.grd contour layer to select it.
2. In the **Properties** window, click on the **Levels** tab.
3. Change the **Level method** by clicking on the word **Simple** next to **Level method** and selecting **Advanced** from the list.
4. Click the **Edit Levels** button next to **Contour levels** to open the advanced **Levels for Map** dialog.
5. Clicking the column header buttons makes bulk changes at regular intervals. Click on the **Label** button. The **Labels** dialog opens.
6. Change the **First** value to 2, the **Set** value to 1, and the **Skip** value to 2.
   - The **First** value tells Surfer which contour line to first change. This says to set the label format for the second contour line (Z=30).
   - The **Set** value tells Surfer how many lines to set with this style. This says to set only one line with the label format.
   - The **Skip** value tells Surfer how many lines to skip before setting the next contour line. This says to skip two contour lines. So, the Z=40 and Z=50 contours are not set. The next contour line Z=60 uses the label format. Z=70 and Z=80 are skipped. Z=90 is set. Z=100 is skipped.
7. Click the **Font** button. The **Font Properties** dialog opens.
8. Set the **Size (points)** to 14.
9. Set the Foreground color and opacity color to White.
10. Click **OK** in the **Font Properties** dialog.
11. Click **OK** in the **Labels** dialog. Notice how the label status is changed in the **Levels for Map** dialog.
12. Click on the **Hach** button. The **Hachures** dialog opens.
13. Set the **First** to 1, the **Set** to 1, and the **Skip** to 0.
   - The **First** value tells Surfer to set the hachure setting for the first contour line, Z=20.
   - The **Set** value tells Surfer to set only one contour line to the hachure style.
   - The **Skip** value tells Surfer how many contours to skip. In this case, no contours are skipped. This means that all of the contours will have the hachure style.
14. Check the **Hachure Closed Contours Only** box, if it is not already checked.
15. Change the Direction to Uphill.
16. Click **OK** in the **Hachures** dialog. This changes all of the items under **Hach** to Yes. All closed contours will have hachure marks.
17. Click **OK** in the **Levels for Map** dialog and the bulk changes are made to the contour map.

Now we will open the **Levels for Map** dialog again and set properties for individual contour levels:
1. In the **Contents** window, click once on the **Contours-Tutorial.grd** contour layer to select it.
2. In the **Properties** window, click on the **Levels** tab.
3. Make sure that the **Level method** is set to **Advanced**.
4. Click the **Edit Levels** button next to **Contour levels** to open the advanced **Levels for Map** dialog.
5. In the **Levels for Map** dialog, you can double-click an individual Z value in the list underneath the **Level** button to change the Z value for that particular contour level. Let’s double-click on the number 60.
6. In the **Z Level** dialog, highlight the value 60 and type in 65.
7. Click **OK** in the **Z Level** dialog, and the contour line level changes to 65.
8. You can also double-click the line style for an individual level to modify the line properties for the selected level. This provides a way to emphasize individual contour levels on the map. Double-click on the line style next to the level 70.
9. In the **Line Properties** dialog, change the **Style** to a solid line by clicking on the dashed line and selecting the **Solid** line from the list.
10. Click **OK** in the **Line Properties** dialog.
11. Let’s add a single contour line halfway between two existing values. Click on the number 65 under the **Level** column.
12. Click the **Add** button. The value 57.5 is added between the 50 and the 65.
Use the **Levels for Map** dialog to make bulk and individual changes to contour levels.

13. Click **OK** in the **Levels for Map** dialog and the individual settings are made to the contour map.

Adding, Deleting, and Moving Contour Labels - Tutorial

Contour label locations can be changed on an individual basis. Labels can be added, deleted, or moved. This section will demonstrate adding, deleting, and moving contour labels:

1. Select the contour layer by clicking the **Contours-Tutorial.grd** object in the **Contents** window.
2. Click the **Map Tools | Edit Layer | Contour Labels** command or right-click on the contour map and select **Edit Contour Labels**. The cursor changes to ▶ to indicate that you are in edit mode. Contour labels have rectangular boxes around them in edit mode.
3. To delete a label, click on the label and press the DELETE key on the keyboard. For example, left-click on one of the 65 labels and press the DELETE key on your keyboard.
4. To add a label, press and hold the CTRL key on the keyboard and left-click the location on the contour line where you want the new label to be located. The cursor changes to a black
5. To move a contour label, left-click on the label, hold down the left mouse button, and drag the label. Release the left mouse button to complete the label movement.
6. To duplicate a label, hold the CTRL key and then click and drag an existing label. The duplicate label will be dragged to a new location along the line.
7. To exit the Edit Contour Labels mode, press the ESC key, click the Home | Selection | Select command, or click the Map Tools | Edit Layer | Contour Labels command.

Exporting 3D Contours - Tutorial
When you have completed a contour map in the plot window, you can export the contour lines with associated Z values to an AutoCAD DXF, 2D SHP, 3D SHP, or TXT file. To export contour lines to a DXF, 2D or 3D SHP, or TXT file:
1. Select the contour map layer by clicking Contours-Tutorial.grd in the Contents window.
2. Click the Map Tools | Layer Tools | Export Contours command.
3. In the Save As dialog, type Tutorial contours in the File name box.
4. Select AutoCAD DXF File (*.dxf), 2D Esri Shapefile (*.shp), 3D Esri Shapefile (*.shp), or Text format (*.txt) in the Save as type list.
5. Click Save and the file is exported to the current directory. This creates a file titled Tutorial contours.dxf, Tutorial contours.shp, or Tutorial contours.txt depending on what file type you selected. Additional files may also be created that accompany the DXF or SHP file.

The contours are exported as polylines or polygons. The labels and gaps are removed. The exported file can be used in Surfer as a base map, or used in other applications. The File | Export command can also be used to export 2D or 3D contours. A comparison between the Export Contours and Export commands is available on the Export Contours help topic.

Changing the Post Layer Properties - Tutorial
Symbols in a post map can all be the same or can be selected with a worksheet column. Symbol sizes can all be the same or have proportional sizes. Symbol colors can all be the same or have color based on a column. Now we will edit the post map layer properties:
1. Click on the Post-Tutorial.dat layer in the Contents window.
2. In the Properties window, click on the Symbol tab.
3. Click the ▶ next to Symbol, if the Symbol section is not already expanded.
4. Click the ▶ next to Symbol Properties to open the Symbol Properties section.
5. Click the selected symbol next to the Symbol property. In the list, click on the filled diamond symbol (Symbol set: GSI Default Symbols, Number: 6) from the symbol palette.
6. Click the next to Symbol Size to open the Symbol Size section.
7. Highlight the value next to the Symbol size option and type 0.15 in.
8. Press ENTER on the keyboard. The symbols update with the new symbol size.
9. Click the next to Symbol Color.
10. To change the symbol colors based on a worksheet value, click on the None next to the Color column option and select Column C: Elevation.
11. Verify that the Color method is set to Numeric via colormap.
12. Click the colormap next to the Symbol colors and select the desired colormap, such as Terrain.

If the post map is not visible, ensure that the post layer is on top of the contour layer in the Contents window. The order the layers are listed in a map object is the order the map layers are drawn in the plot window. To move the post layer in the Contents window, left-click and drag the post layer above the other layers in the map object. Alternatively, select the post layer and click the Layout | Arrange | Bring to Front | Bring Forward command, or right-click the post layer and select Order Objects | Move Forward.

Adding Labels to the Post Layer - Tutorial
You can add labels to the data points on post maps and classed post maps. Multiple labels can be added to display all of the information desired in the map. We will add labels showing the elevation and names for the data points:

1. Click on the Post-Tutorial.dat layer in the Contents window.
2. In the Properties window, click on the Labels tab.
3. Click the next to Label Set 1, if the section is not already open.
4. Next to Worksheet column, click the word None. A list displaying all of the columns in Tutorial.dat are displayed. Select Column C: Elevation from the list.
5. For the Position relative to symbol option, click on the existing option and select Below from the list.
6. Click the Add button next to the Add label set option to add a second label to the post map.
7. Next to Worksheet column, click the word None. A list displaying all of the columns in Tutorial.dat are displayed. Select Column D: Name from the list.
8. For the Position relative to symbol option, click on the existing option and select Above from the list.
9. Click the next to Font Properties to open the Font Properties section.
10. Change the Background opacity to 33%. This places a semi-transparent white box around the names.

The post map layer is automatically redrawn with labels on each of the data points.
Add labels to post maps in the Properties window on the Labels tab.

Moving Individual Post Labels - Tutorial
You can move individual labels on post maps and classed post maps with the Map Tools | Edit Layer | Post Labels command. Alternatively, add labels, and then right-click the post map and select Edit Post Labels to enter edit mode. A customizable line is automatically added from the data point label to the actual X, Y data point location.

1. Select the Post-Tutorial.dat layer in the Contents window.
2. Click the Map Tools | Edit Layer | Post Labels command or right-click on the selected map and select Edit Post Labels. The cursor will change to indicate you are now in post label editing mode.
3. Left-click on a label, hold the left mouse button down, and drag the label to a new location. With the left mouse button held down, the arrow keyboard keys can be used to nudge the label location. Release the left mouse button to place the label in the new location. A leader line will be added from the point location to the new label location by default. The leader line visibility and line properties are controlled on the Labels page in the Properties window when the post layer is selected.
4. Press the ESC key to exit the post label editing mode.
Lesson 4 - Modifying an Axis

Every map is created with four map axes: the bottom, right, top, and left axes. 3D maps also have an additional Z axis. You can control the display of each axis independently of the other axes on the map. Additional left, right, top, bottom, or Z axes can be added to a map with the Map Tools | Add to Map | Axis commands. In this example, we will change the axis label spacing and add an axis title:

1. Move the cursor over one of the axis tick labels on the bottom X axis and left-click the mouse. In the status bar at the bottom of the plot window, the words "Map: Bottom Axis" are displayed. The Bottom Axis object is selected in the Contents window. This indicates that you have selected the bottom axis of the map. Additionally, blue circle handles appear at each end of the axis, and green square handles appear surrounding the entire map. This indicates that the axis is a "sub-object" of the entire map.
2. The bottom axis properties are displayed in the Properties window. Click on the General tab.
3. Click the next to Title to open the Title section if it is not already open.
4. Click in the box next to Title text. Type Bottom Axis and press the ENTER key on the keyboard. This places a title on the selected axis. Alternatively, click the button. Type the text in the Text Editor and click OK.
5. If you cannot see the axis title, click the View | Zoom | Selected command. The map automatically increases its size to fill the plot window.

Changing the Tick Label Properties - Tutorial

All properties of the axis can be edited, including the tick label format and frequency. We will change both format and frequency in this example:

1. In the Properties window, click on the Scaling tab to display the axis scaling options.
2. In the Major interval field, highlight the value 1 and type the value 1.5.
3. Press ENTER on the keyboard to place 1.5 X map units between tick marks. This spacing automatically updates on the map axis.
4. Click on the Labels tab in the Properties window.
5. Click the next to Labels, if it is not already open.
6. Click the next to Label Format to open the Label Format section.
7. In the Label Format section, select Fixed for the Type.
8. Click in the box next to Decimal digits. Highlight the existing value and type the value 1.
9. Press ENTER on the keyboard. This indicates that only one digit follows the decimal point for the axis tick labels.

The map is updated immediately after every change, showing the axis tick spacing, labels, and the axis title.

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Lesson 5 - Creating a Profile

The ability to slice a grid file in Surfer to create a file of data points along a specified line of section is a very powerful tool. The sliced data can be visually displayed as a profile in Surfer, or multiple profiles can be combined to display a cross section. However, the Map Tools | Add to Map | Profile command provides an excellent quick method to producing a profile from a grid-based map. The profile trace will be drawn directly on the map:

1. Click once on the Contours-Tutorial.grd contour layer to select it.
2. Click the Map Tools | Add to Map | Profile command. The cursor changes to a "I" to indicate that you are in the drawing mode.
3. Click inside the contour map near the (0,4) and (9,4) coordinate locations. The exact coordinates of the cursor are displayed in the status bar for reference.
4. After the second point has been clicked, a line connects the points. Press ENTER on the keyboard to end drawing mode.
5. Click the View | Zoom | Fit to Window command to see the entire map and profile.

The Base(vector)-Profile 1 layer is automatically added to the map and the profile graph is automatically created. The properties can be edited by clicking on the Profile 1 object in the Contents window and adjusting the properties in the Properties window.
Lesson 6 - Saving a Map

When you have completed the map in the plot window, you can save the map to a **Surfer** .SRF file. **Surfer** .SRF files contain all the information necessary to reproduce the project. When you save a map as a .SRF file, all the scaling, formatting, and map properties are preserved in the file. An asterisk (*) next to the file name in the title bar and tab indicates the file has been modified and the modifications have not yet been saved.

1. Click the **File | Save** command or click the button on the quick access toolbar. The **Save As** dialog is displayed because the map has not been previously saved. Set the **Save in** directory to any directory on your computer.
2. In the **File name** box, type **Tutorial**.
3. Make sure that the Save as type is set to Surfer 16 Document (*.srf).
4. Click **Save** and the file is saved to the current directory with a .SRF extension. The saved map remains open and the title bar changes to reflect the name change. There is no longer an asterisk next to the file name.

If desired, the **Save as type** can be set to **Surfer 11 Plot (*.srf)**, **Surfer 12 Plot (*.srf)**, **Surfer 13 Plot (*.srf)**, **Surfer 14 Plot (*.srf)**, or **Surfer 15 Plot (*.srf)** if the file is to be shared with users using **Surfer 11**, **Surfer 12**, **Surfer 13**, **Surfer 14**, or **Surfer 15**. After selecting the format, click **Yes** in the dialog. Any **Surfer 16** specific features are lost when saving to a previous **Surfer** version format.
Lesson 7 - Creating a 3D Surface Map

Surfaces are three-dimensional shaded renderings of a grid file. Surfaces provide an impressive visual interpretation of data. Surfaces can be layered with other surfaces, so that the surfaces will intersect with each other. Surfaces can also have layers of other map types, excluding 3D wireframes. Surfaces allow you to generate an elevation model of your area of interest and then add layers of data on the top of the surface. You can control the color, lighting, overlay blending, and wire mesh grid of a 3D surface.

For example, if you have location (X, Y) and temperature (Z) data for a region and you have the same location (X, Y) and corresponding elevation (Z) data for the area, you could create a grid file with the Z variable being elevation and a grid file with the Z variable being temperature. You could create a 3D surface of the elevation grid to represent topography, then add a contour map of the temperature variation. You could continue to add map layers, such as a classed post map layer with the temperature collection stations that have different symbols depending on the elevation.

We are going to use the same grid file you used to create the tutorial contour map. The 3D surface map will provide a new perspective to the contour map you have already created. Although we are going to create this map in a new plot window, the surface map could easily be added to the existing plot window.

1. Click the File | New | Plot command or click the button on the quick access toolbar to open a plot document.
2. Click the Home | New Map | 3D Surface command.
3. In the Open dialog, select the grid file Tutorial.grd from the list of files. The Tutorial.grd file was created in Lesson 2 - Using the Map Wizard.
4. Click Open and the 3D surface is created using the default settings.

Adding a Mesh - Tutorial

Mesh lines can be applied to surfaces. 3D surface maps have more capability than 3D wireframe maps. 3D surfaces can be combined with more map types, and the surface map limits can be changed. Adding mesh lines to a 3D surface map simulates a 3D wireframe map. We will add a surface mesh to the map:

1. Click once on 3D Surface-Tutorial.grd in the Contents window to select it. The 3D surface properties are displayed in the Properties window.
2. Click the Mesh tab.
3. Check the box next to the Draw lines option in both the Lines of Constant X and Lines of Constant Y sections.
4. Change the Frequency in both the Lines of Constant X section and Lines of Constant Y section to 5.

The mesh is automatically added to the selected 3D surface.

![Image: The mesh lines indicate lines of constant X and Y on the 3D surface.]

Changing the 3D Surface Layer Colors - Tutorial

Changing color schemes on 3D surfaces is similar to changing colors on other map types such as color relief maps or contour maps. A colormap is used to load previously defined color schemes or to create your own color schemes. In this example, we will use a modified Rainbow colormap:

1. Click on the 3D Surface-Tutorial.grd layer in the Contents window to select it.
2. In the Properties window, click on the General tab.
3. Click the button next to Material Color to open the section if it is not already open.
4. Click the button to the right of the selected colormap for Upper. The Colormap Editor opens.
5. In the Colormap Editor, select the Rainbow colormap from the Presets list in the Color Mapping group. The Presets list contains a variety of predefined color schemes.
6. The Rainbow preset has six nodes that range from purple to red. You can add, remove, apply opacity, customize the nodes, or accept the default selections. To reverse the color order, click the Reverse button.
7. Click OK in the Colormap Editor to update the surface map properties with your color changes.

You can continue to experiment with the colors by selecting other color spectrums from the list next to Upper. Or, click the button to the right of the colormap and make changes in the Colormap Editor. You can experiment with selecting custom node locations, colors, and opacities.
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This is a 3D surface map with a mesh displayed at a frequency of five. The 3D surface map is using the reverse of the Rainbow color spectrum.

Adding a Surface Map Layer - Tutorial

You can add additional map layers to the 3D surface with the Home | Add to Map | Layer command. All map layers, except other 3D surfaces, are converted into a type of image known as a texture map. This texture map is then applied to the surface by stretching it and shrinking it as necessary. When these maps are added to the surface map, you have a choice on how to treat the texture map. You can use the colors from overlays only, from the surface only, or blend colors from the overlays and surface. For example, you could create a color filled contour map, add the contour map and surface, and then use the colors from the contour map only. A 3D wireframe layer cannot be added to a 3D surface map.

When multiple 3D surfaces of differing elevations are added, the surfaces can intersect and overlap each other. If a surface map is added to another surface map with the Home | Add to Map | Layer | 3D Surface command and the two maps are adjacent to each other in the X or Y direction, the surfaces are drawn side-by-side. In this example, we will add a planar layer to the surface you just created:

1. Click on the 3D Surface-Tutorial.grd layer in the Contents window.
2. Click the Home | Add to Map | Layer | 3D Surface command, or right-click the surface map and select Add to Map | 3D Surface.
3. In the Open Grid dialog, select the planar grid, TutorPl.grd from Surfer’s Samples directory. If you are not in the Samples folder, browse to it. By default, the Samples folder is located in C:\Program Files\Golden Software\Surfer 16.
4. Click Open and the new surface map layer is added using the default settings.
5. Click on the 3D Surface-TutorPl.grd surface map layer in the Contents window.
6. In the Properties window, click on the General tab.
7. Click the button next to Material Color to open the Material Color section.
8. Click the button next to Upper to open the Colormap Editor.
9. In the Color Mapping group, select Rainbow in the Presets list.
10. Click Reverse to match the colormap in the 3D Surface-Tutorial.grd layer.
11. In the Data section, type 25 in the Min field, and type 104.9 in the Max field. Now the surfaces use the same colormap mapped to similar data values.
You can overlay two or more 3D surfaces. Depending on each surface's XYZ ranges, the surfaces may overlap or intersect each other. This example shows the intersection of the Tutorial.grd and TutorPl.grd sample files.

If you wish to save your map, click the **File | Save** command. We will create a new plot in the next lesson.

**Lesson 8 - Adding Transparency, Color Scales, and Titles**

The opacity of a map, image, text, line, fill, symbol, or entire layer can be customized in **Surfer**. Opacity is the amount of light that is obscured by an object. An object can be made semi-transparent by adjusting the opacity value. Reducing the opacity of an object makes other objects visible through the less than 100% opaque object. An *Opacity* value of 0% means that the object is invisible. An *Opacity* value of 100% means that the object is fully opaque. Setting the opacity is useful when creating a semi-transparent map layer. For example, you may want to display a semi-transparent contour map layer over a satellite image base map layer so that both map layers can be seen. Being able to set the *Opacity* of entire layers is especially useful when you have multiple layers with filled objects and you need to see all of the layers.

**Creating a Filled Contour Map**

First, we will create a filled contour map:

1. Click the **File | New | Plot** command or click the button on the quick access toolbar. A new empty plot window is displayed.
2. Click the **Home | New Map | Contour** command.
3. Select the grid file *Golden.grd* from the list of files in the **Open Grid** dialog. By default, the *Samples* folder is located in C:\Program Files\Golden Software\Surfer 16.
4. Click **Open**. The map is created using the default settings. Some settings are persistent while **Surfer** is open. If you have completed **Lesson 3** in the same session, the map created in this step will have uphill hachures and white-text contour labels.
5. Click on the contour map layer to select it.
6. In the **Properties** window, click on the **Levels** tab.
7. Set the *Level method* to *Simple*, if it is not already *Simple*.
8. Click the button next to *Filled Contours* to open the *Filled Contours* section, if it is not already open.
9. Check the box next to *Fill contours* to fill the contours.
10. Click the button next to *Labels* to open the *Labels* section, if it is not already open.
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11. Click the next to Font properties to open the Font properties section.
12. If the Foreground color is not Black, click the current color and select Black from the color palette.

Adding Transparency to Map Layers - Tutorial
You can adjust the Opacity value of a map layer or of individual contour fill, polygon fill, text, lines, or symbols when the appropriate object is selected. Adjusting the Opacity for an entire layer may be useful when you have multiple map layers and need to make one or more layers semi-transparent to best represent your data. For this example, we will adjust the opacity for the contour fill while keeping the contour lines and labels completely opaque.
1. Click on the Contours-Golden.grd layer in the Contents window to select it.
2. In the Properties window, click on the Levels tab.
3. Click the button next to Fill colors. The Colormap Editor opens.
4. In the Color Mapping section, click the current selection in the Presets list and select Terrain.
5. In the Opacity Mapping section, click highlight the current 100.00% value next to the Opacity option and type 30.
6. Click OK in the Colormap Editor. The Terrain colormap and 30% opacity setting is applied to the contour layer's Fill colors. Notice Custom is displayed in the Fill colors field.

Adding and Editing a Color Scale - Tutorial
Color scales are legends that show the fill colors. Color scales are available for contour, 3D wireframe, 3D surface, color relief, and vector maps. The color scale displays the colors assigned to levels in a filled contour map or 3D wireframe, the colors used in a color relief map or 3D surface, and the fill assigned to vector symbols. Let's add a color scale and color scale title to the contour map
1. Click on the Contours-Golden.grd contour layer to select it. The properties are displayed in the Properties window.
2. Click on the Levels tab in the Properties window.
3. Click the next to Filled Contours to open the Filled Contours section, if it is not already open.

The contour map is displayed with a partially transparent fill color.
4. Select the box next to Color scale. A default color scale is created. A new Color Scale object is added to the Contents window.
5. Click on Color Scale in the Contents window to select it.
6. In the Properties window, click on the General tab to edit the color scale properties.
7. Click the next to Title to open the Title section, if it is not already open.
8. Click in the empty box next to Title text.
9. In the Title text field, type Elevation (feet).
10. Press ENTER. The title is added with the default settings.
11. Change the title position by clicking the current selection next to Position. Select Top from the Position list.

Notice the color scale title moves to the top of the color scale, and the text orientation automatically changes to horizontal. The color scale has the same opacity as the contour layer when transparency is applied to the contour layer Fill colors colormap.

The map and color scale object are shown in this image.

Downloading an Online Base Map Layer - Tutorial
A base map layer can be added below the existing semi-transparent contour layer to enhance the map’s appearance. To add a base map layer from an online server,
1. Click anywhere on the map to select it.
2. Click the Home | Add to Map | Layer | Base from Server command to download an image base map from an online server. The Download Online Maps dialog is displayed. Surfer can download base layers from WMS, OSM, and WFS servers. Surfer can also download grids from WCS servers.
3. In the Download Online Maps dialog, click the next to OpenStreetMaps Imagery.
4. Click the OpenCycleMap server in the OpenStreetMaps Imagery category. A preview is displayed in the preview section.
5. Notice Specify Latitude/Longitude Extents is selected, and the values are set to the boundaries of the Map. When the map coordinate system is a geographic or projected system and the Home | Add to Map | Layer | Base from Server command is used, the area to download will be automatically set to the map extents.
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6. For the tutorial, we will use the default setting in the Select Image Resolution to Download section.
7. Click OK and the base layer downloads. The base layer is automatically placed behind the contour layer. If a Surfer Warning dialog appears prompting you to adjust the map limits, click No.

Increasing the image resolution will increase the download size when retrieving layers with the Download Online Maps dialog. With some servers such as the OpenCycleMap server, increasing the resolution will also return a different layer than the one displayed in the preview. Feel free to experiment with different resolutions by repeating steps 2 through 9 and selecting a higher or lower resolution in step 7. You will need to hide previous base layers to view the new one. In the Contents window, clear or select the check box next to the Contours-Golden.grd or Base(raster)-OpenCycleMap layers to toggle the visibility of the maps on and off.
Adding a Map Title - Tutorial

Adding a title to a map is a great way to stay organized and create publication quality maps.

1. Click once on the Top Axis in the Contents window to select it.
2. In the Properties window, click on the General tab.
3. Click the ☐ next to Title, if the section is not already open.
4. In the box next to Title text, click the ☐ button to open the Text Editor. The Text Editor provides more control over the text appearance than the Properties window.
5. Type Tutorial Map and press the ENTER key on the keyboard.
6. On the second line, we will use a dynamic predefined math text instruction to insert the current date. Click the ☐ button.
7. In the Date/Time Format Builder dialog, select the desired date/time format in the Predefined date/time formats list. For instance, select dd-MMM-yy.
8. Click Insert next to the selected date/time format in the Predefined date/time formats list. Notice the format in the Date/Time format field updates to the selected format.
9. Click OK in the Date/Time Format Builder dialog. Today's date is added to the Text Editor.
10. Select the date in the Text Editor by double-clicking the date or by clicking and dragging across the date.
11. Click the ☐ button to make the highlighted text bold.
12. Select the Tutorial Map text.
13. Change the Size (points) to 14. The size is located immediately to the right of the font name.
14. Click the center justification button ☐ to center the text.
15. Click OK to close the Text Editor.

The map is automatically updated with the new map title. Save the project if you wish. We will open a new plot window in the next lesson.
Lesson 9 - Creating Maps from Different Coordinate Systems
Map layers from different coordinate systems can be created in the same map frame. **Surfer** converts the source coordinate system for each map layer to the target coordinate system for the entire map. The axes display the target coordinate system. A coordinate system is method of defining how a file's point locations display on a map. Different types of coordinate systems exist that control how the coordinates are shown on the map. In **Surfer**, a map can be unreferenced in local coordinates, referenced to a geographic lat/long coordinate system, or referenced to a known projection and datum.

Creating the First Map - Tutorial
First, we will create a map with a defined coordinate system in **Surfer**:
1. Click the **File | New | Plot** command to open a new plot window.
2. Click **Home | New Map | Contour** to create the map with a contour layer.
3. In the **Open Grid** dialog, click on the **Diablo.grd** file from **Surfer's Samples** folder. If you are not in the **Samples** folder, browse to it. By default, the **Samples** folder is located in C:\Program Files\Golden Software\Surfer 16.
4. Click **Open**. The contour map is created.
5. Click on **Contours-Diablo.grd** in the **Contents** window to select the contour layer.
6. Click the **Levels** tab in the **Properties** window. Set the interval, fill, and contour lines properties for the contour map using the methods described in Lesson 3 and Lesson 8.

7. In the **Properties** window, click on the **Coordinate System** tab. Note that the contour map layer was imported with a coordinate system already specified. This map layer is in the **State Plane 1927 - California III (Meters)** coordinate system.

![The first map layer is created with a predefined coordinate system.](image)

**Adding a Post Map Layer - Tutorial**

Maps can be created without predefined coordinate systems and assigned the correct coordinate system in the layer properties.

1. Create a new post map with the **Home | New Map | Post** command.
2. In the **Open Data** dialog, select the **Diablo Example.dat** file in the **Surfer Samples** directory. If you are not in the **Samples** folder, browse to it. By default, the **Samples** folder is located in `C:\Program Files\Golden Software\Surfer 16`.
3. Click **Open**.
4. Click on the **Map** in the **Contents** window that contains the post map to select it.
5. Click and drag the map in the plot window to move the post map. Move the post map until the two maps are side by side. Note that the axes on the two maps have very different coordinates.
6. Click on **Post-Diablo Example.dat** in the **Contents** window to select the post layer.
7. In the **Properties** window, click on the **Coordinate System** tab. Note that the post map does not have a predefined coordinate system.
8. Click the **Set** button to define the coordinate system for the post map. The **Assign Coordinate System** dialog is displayed. Since we know this coordinate system, we can set it.
9. We can use the search bar to reduce the number of projections listed in the **Assign Coordinate System** dialog, since we know the map coordinate system. In the **Search for text or EPSG code** box, type **UTM Zone 10N**.
10. Press **ENTER** or click the **button.
11. In the **Assign Coordinate System** dialog, click the **Predefined** to open the **Predefined** section.
12. Click the **Projected Systems** to open the **Projected Systems** section.
13. Click the $\text{next to UTM}$ to open the $\text{UTM}$ section.
14. Click the $\text{next to North America}$ to open the $\text{North America}$ section.
15. Click on the $\text{North America NAD27 UTM Zone 10N}$ coordinate system to select it.
16. Click $\text{OK}$. On the $\text{Coordinate System}$ tab, the post layer shows the defined coordinate system next to $\text{Name}$.

![Two maps with different coordinates](image)

The two maps are displayed side by side with very different coordinates displayed on the axes.

17. In the $\text{Contents}$ window, click and drag the $\text{Post-Diablo Example.dat}$ layer into the $\text{Map}$ just above the $\text{Contours-Diablo.grd}$ map layer. The two map layers are now overlaid. You can see the posted symbols are located on the contour lines, despite the different coordinate systems.

**Setting the Target Coordinate System for the Map - Tutorial**

The target coordinate system is the system displayed in the plot and on the map axes. Once all map layers are defined, the target coordinate system can be changed to any desired coordinate system.

1. Click on the $\text{Map}$ object in the $\text{Contents}$ window.
2. In the $\text{Properties}$ window, click on the $\text{Coordinate System}$ tab.
3. Click the $\text{Change}$ button.
4. In the $\text{Assign Coordinate System}$ dialog, click the $\text{next to Predefined}$ to open the $\text{Predefined}$ section.
5. Click the $\text{next to Geographic (lat/lon)}$ to open the $\text{Geographic (lat/lon)}$ section.
6. Click on $\text{World Geodetic System 1984}$ near the bottom of the list to select it.
7. Click $\text{OK}$.

The map now has a different coordinate system than either the contour or post map layers on the $\text{Coordinate System}$ page. Notice that the axes are now showing latitude and longitude values as well. In the above section, we did not use the search function in the $\text{Assign Coordinate System}$ dialog. When searching in the $\text{Assign Coordinate System}$ dialog, the search string must exactly match a portion of the desired coordinate system name or EPSG code. However, the search string does not need to be the complete name or EPSG code. For example, searching for $\text{System 1984}$ will return the $\text{World Geodetic System 1984}$ coordinate system, but searching for $\text{World 1984}$ returns no results.
The map axes now display latitude and longitude coordinates.

Changing the Axis Label Format - Tutorial
The axis labels can be displayed in a variety of number formats. We will change the axis labels to Degrees, Minutes, Seconds format.

1. Click on the Left Axis object in the Contents window.
2. In the Properties window, click on the General tab to view the General page.
3. Click the next to Labels if the Labels section is not already open.
4. Click the next to Label Format to view the Label Format properties.
5. Click the current selection next to Type and select DMS (Lat/long) from the list.
6. Click on the Bottom Axis object in the Contents window.
7. Repeat steps 2 through 5 for the Bottom Axis.

The axis labels are now in Degrees, Minutes, Seconds format. Many additional edits can be made to the map. You can continue to experiment with the various coordinate systems or editing any portion of the map layers.
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The final map contains two overlaid layers, each with different source coordinate systems. The axis labels are in Degrees, Minutes, Seconds format.

Tutorial Complete
Congratulations! You have completed the Surfer tutorial. The remaining tutorial lessons are optional advanced lessons. It is recommended that you complete the optional lessons, because these lessons provide additional information about how Surfer works. If you have questions, try looking for answers in the online help, quick start guide, online knowledge base, and interactive forum. If you find you still have questions, do not hesitate to contact Golden Software’s technical support team.

Optional Advanced Lessons
By completing lessons 1 through 9 of the tutorial, you now have a basic understanding of Surfer and how to create and customize basic maps.

The remaining tutorial lessons are optional advanced lessons.

Lesson 10 - Customizing the User Interface shows you how to modify the quick access toolbar, ribbon, and keyboard shortcuts to improve your efficiency in Surfer.

Lesson 11 - Overlaying Map Layers shows you the three methods to overlay map layers.

Lesson 12 - Assign NoData Values to a Grid File shows you how to create a blanking file and use the Grids | Edit | Assign NoData command to create a grid file with an irregular boundary.
Lesson 10 - Customizing the User Interface

The ribbon interface is efficient and easy to use by default. However, as you develop workflows and processes, you may find you can make Surfer even easier to use by customizing the quick access toolbar, ribbon, or keyboard commands.

Customize the Quick Access Toolbar

If you use a command frequently, you may want to add the command button to the quick access toolbar. This can easily be accomplished in Surfer. In this example, we'll add a separator and three commands.

1. Click the File | Customize Ribbon command to open the Customize dialog, or right-click the ribbon and select Customize Quick Access Toolbar.
2. Click the Quick Access Toolbar tab on the left side of the Customize dialog.
3. Click the <Separator> at the top of the Commands list on the left side of the dialog.
4. Click Select at the bottom of the quick access toolbar list on the right side of the dialog. Any additions from the Commands list will be placed below the item selected in the quick access toolbar list.
5. Click Add to add a separator to the end of the quick access toolbar.
6. Scroll down the Commands list and click Polyline.
7. Click Add to add the Home | Insert | Polyline command to the quick access toolbar.
8. Repeat steps 7 and 8 and add the Polygon and Reshape commands to the quick access toolbar.
9. Click OK in the Customize dialog to update the quick access toolbar with the new changes.

Now the quick access toolbar includes the Polyline, Polygon, and Reshape commands after the default commands.

Customize the Ribbon

The ribbon can be modified by adding new tabs, adding new command groups, adding commands to tabs or groups, and rearranging the tabs, groups, and commands.

1. Open the Customize dialog by clicking the File | Customize Ribbon command.
2. Click the Ribbon tab on the left side of the Customize dialog.
3. Select Main Tabs in the Customize the Ribbon field, if it is not already selected.
4. Click the next to Home to expand the tab.
5. Click the Insert group at the bottom of the Home list. We will insert a new group below the Insert command group.
6. Click New Group. Commands must be added to a custom command group. Default command tabs and groups cannot be modified. However, default command groups can be removed and default command tabs can be hidden if desired.
7. Click Rename to rename the new command group. The Rename dialog is displayed.
8. Type a name for the command group, such as My Commands.
9. Press ENTER or click OK in the Rename dialog.
10. Select All Tabs in the Choose commands from field.
11. Click the next to Layout to expand the Layout tab commands.
12. Click the next to Arrange to expand the Arrange command group.
13. Click Align in the Choose commands from list.
14. Click Add to add the Align subgroup to the My Commands (Custom) command group.
15. Click OK in the Customize dialog to add your commands to the ribbon.

Notice on the Home tab, there is now a Home | My Commands group. You can use the File | Customize Ribbon command to tailor your Surfer experience to fit you.
Creating Keyboard Shortcuts
There are often times where you may use a command often enough to merit creating a custom keyboard shortcut. This can easily be accomplished in Surfer. In this example, we will add a keyboard shortcut to the Grid Data command.

1. Click the File | Customize Ribbon command to open the Customize dialog.
2. Click Customize next to Keyboard shortcuts near the bottom of the Customize dialog. The Customize Keyboard dialog is displayed.
3. Select Grids in the Categories list.
4. Select Grid Data in the Commands list. Notice nothing is displayed in the Current Keys field. This means there are no keyboard shortcuts assigned to the Grid Data command.
5. Click in the box next below Press New Shortcut Key.
   - If no other command has this keyboard shortcut, [Unassigned] will be displayed below Assigned to. If the shortcut is not assigned to another command, click the Assign button. The shortcut is added to the Current Keys list.
   - If another command has the keyboard shortcut, the command is listed below Assigned to. If this is the case, the Assign button is grayed out. Select a different shortcut key for the command. Each shortcut key can be assigned to only one command.
7. Click the Assign button at the bottom of the Customize Keyboard dialog.
8. Click Close in the Customize Keyboard dialog.
9. Click OK in the Customize dialog.
10. In the plot window, press the CTRL + SHIFT + D command on the keyboard. The Grid | Data command is executed, and the Open Data dialog opens. Click Cancel in the Open Data dialog.
Custom keyboard shortcuts can be added to any command.

Removing the Customizations
You may wish to revert the quick access toolbar, ribbon, and keyboard shortcuts back to their default state.
1. Click the File | Customize Ribbon command.
2. Click Reset next to Customizations to clear the ribbon customizations. Click Yes in the Surfer warning dialog.
3. Click the Quick Access Toolbar tab in the left side of the Customize dialog.
4. Click Reset below the quick access toolbar command list. Click OK in the Surfer warning message.
5. Click Customize next to Keyboard shortcuts to open the Customize Keyboard message.
6. Click Reset All in the Customize Keyboard dialog. Click Yes in the Surfer warning message.
7. Click Close in the Customize Keyboard dialog.
8. Click OK in the Customize dialog.
Now all the tutorial customizations have been removed. This process can be used to remove customizations in the future should you wish to revert to the default state.

Lesson 11 - Overlaying Map Layers
Surfer 16 has three methods of overlaying map layers onto a single map object. You can drag a map layer from one map object to another map object in the Contents window, you can select a map and click the Home | Add to Map | Layer command to add a map layer, or you can select multiple map objects and use the Map Tools | Map Tools | Overlay Maps command.
Chapter 2 - Tutorial

This tutorial will cover all three methods that are available to overlay map layers in Surfer. This tutorial will also cover combining maps from different Surfer .SRF files.

Before we start, it is important to understand the difference between a map object and a map layer. The Contents window is the easiest place to see the difference between a map object and a map layer.

A map object is listed in the Contents window as Map. A map object consists of axes and an optional map layer or map layers. Click on the Map object to open the map properties in the Properties window, where the View, Scale, Limits, Frame, Coordinate System, and Info are controlled.

A map layer is listed in the Contents window as the map type name (i.e. Contours). A single map layer or multiple map layers can be part of a map object. Click on the map layer (i.e. Contours) to open the properties for the selected map type (i.e. contour map properties) in the Properties window. The specific properties related to the map type are controlled separately from the entire map properties.

Method 1: Adding a Map Layer to an Existing Map Frame

1. Create a new map with a Home | New Map command. Click Home | New Map | Contour to create a contour map.
2. Select a grid file in the Open Grid dialog. Select the Demogrid.grd sample file and click Open.
3. Select the map and click the Home | Add to Map | Layer command to add a map layer. Select the map layer type to add to your existing map. Select the contour map and use the Home | Add to Map | Post command to add a post map layer to the contour map.
4. Select a data file in the Open Data dialog. Select the Demogrid.dat sample file and click Open.
5. The maps are combined in the correct position based on their coordinates and limits. For example, in the Contents window, you will see one map object with a contour map layer and a post map layer.
Method 2: Combining Two Existing Maps in the Contents Window

If two maps already exist, you can move (or overlay) a map layer from one map frame into the other map frame by dragging and dropping in the Contents window.

1. Create a new base map with a Home | New Map command. Click the Home | New Map | Base command.
2. Select the DemoRect.bin sample file in the Import dialog and click Open.
3. Note that each map has an independent set of axes.

The contour and post layers are in one map. The base layer is in a separate map. This is reflected in the Contents window and the plot window.

2. Select the base map layer in the Contents window and drag it to the map object that includes the contour and post layers. To do this, left-click and hold the left mouse button while you drag the map layer to a new map frame. When the cursor changes to a horizontal arrow, release the left mouse button and the map layer is added to the contour map's map frame. The post map will now be overlaid on the contour map. An empty map frame may remain after removing the last map layer from the map object, depending on your options.

First left-click and select the base map layer (left), then drag the base map layer to the other map object. When the cursor is a horizontal arrow (center), release the mouse button to drop the map layer in the new location (right).
3. If an empty map frame exists, select the empty map frame and press DELETE on the keyboard to remove the empty map frame. The end result is a single map object with three map layers: a post map layer, contour map layer, and base map layer. Additional map layers can be added with the Home | Add to Map | Layer commands.

Method 3: Overlaying Two Existing Maps
1. Create a new base map with a Home | New Map command. Click the Home | New Map | Base command.
2. Select the DemoSlice.bln sample file in the Import dialog and click Open.
3. Add another base layer to the map by clicking the Home | Add to Map | Layer | Base command.
4. Select the DemoText.mif sample file in the Import dialog and click Open.
5. Note that each map has an independent set of axes. Both maps have multiple layers.
6. Click Home | Selection | Select All to select both map objects.
7. Click Map Tools | Map Tools | Overlay Maps. The two maps are combined onto a single map object with a single set of axes. The empty map object is automatically deleted.

Now all five layers are in one Map object.

This method works well when you have multiple map layers that you want to combine.
Lesson 12 - Assign NoData Values to a Grid File

**Surfer** creates grid files that are always rectangular or square. When you need to have a grid file where the contour lines do not cover a rectangular or square area, NoData values will need to be assigned to the grid. The **Grids | Edit | Assign NoData** command combines vector objects, e.g. polygons, with a rectangular grid file. The result is a new grid file where the contours stop at the boundary of the polygon or polygons.

In the previous lesson (Overlaying Map Layers) in methods 1-3, you created a map with a contour map layer, a post map layer, and a three base map layers. The first base map displays the rectangular area of interest, while the contour map displays a larger area than we need to display. Using the **Assign NoData** command, we will create a new grid file that has everything outside the base map rectangle blanked. Click on the plot window that contains the overlaid map layers from the previous lesson. Click on the next to the **Base-DemoText.mif** and **Base-DemoSlice.bln** layers. This will turn the display of these base maps off.

1. First, open the **DemoRect.bln** file in the worksheet by clicking **File | Open**.
2. Select the **DemoRect.bln** sample file in the **Open** dialog and click **Open**. Notice the blanking flag in cell B1 is 0. This means the blanking flag is set to assign NoData values outside the polygon.
3. Click the plot window tab to return to the plot window.
4. In the plot window, click the **Grids | Edit | Assign NoData** command.
5. Click **<None>** in the **Input Grid** section and select the **Contours-Demogrid.grd** layer from the list.
6. Click **<None>** in the **NoData Polygon Boundary** section and select **Base-DemoRect.bln** from the list. Notice the **NoData Outside** option is automatically selected.
7. Click the in the **Output Grid** field. Select a location and file name such as your Documents folder. Type **Demogrid_NoData.grd** in the **File name** field.
8. Click **Save in the **Save Grid As** dialog.
9. Click **[New Map]** next to **Add grid as layer to** and select **Map** from the list.
10. If the **New layer type** is not color relief, click the current selection next to **New layer type** and select **Color Relief** from the list.
11. Click **OK**.
12. Click the **Color Relief - Demogrid_NoData.grd** layer in the **Contents** window.

Now we will assign NoData values to the grid outside of the rectangle in the **Base-DemoRect.bln** layer. Note that it is not necessary to hide the other base layers. However, it may help you determine the extents of the base layer you use for assigning the NoData values.

- First, open the **DemoRect.bln** file in the worksheet by clicking **File | Open**.
- Select the **DemoRect.bln** sample file in the **Open** dialog and click **Open**. Notice the blanking flag in cell B1 is 0. This means the blanking flag is set to assign NoData values outside the polygon.
- Click the plot window tab to return to the plot window.
- In the plot window, click the **Grids | Edit | Assign NoData** command.
- Click **<None>** in the **Input Grid** section and select the **Contours-Demogrid.grd** layer from the list.
- Click **<None>** in the **NoData Polygon Boundary** section and select **Base-DemoRect.bln** from the list. Notice the **NoData Outside** option is automatically selected.
- Click the in the **Output Grid** field. Select a location and file name such as your Documents folder. Type **Demogrid_NoData.grd** in the **File name** field.
- Click **Save in the **Save Grid As** dialog.
- Click **[New Map]** next to **Add grid as layer to** and select **Map** from the list.
- If the **New layer type** is not color relief, click the current selection next to **New layer type** and select **Color Relief** from the list.
- Click **OK**.
- Click the **Color Relief - Demogrid_NoData.grd** layer in the **Contents** window.
13. In the **Properties** window, click on the **General** tab.
14. In the **Hill Shading** section, clear the **Enable hill shading** check box.
15. In the **NoData** section, type 0% in the **Opacity** field or click and drag the slider all the way to the left.

The new grid is used to display a color relief layer within the blanking file boundary.

**Tutorial Complete**

Congratulations! You have completed the advanced **Surfer** tutorial lessons.
Chapter 3 - Data Files and the Worksheet

Data files contain the raw information used to create a grid file, perform residual calculations, or produce post maps. Each record in a data file occupies a single row and is comprised of at least two values (X, Y) for post maps and at least three values for gridding (X, Y, Z). The X, Y, and Z values are each placed in separate columns. The X and Y coordinates define the position of the point on the map, and the Z value defines the value assigned to the specific X, Y location. Common examples of X, Y coordinates include longitude and latitude, easting and northing, or UTM (Universal Transverse Mercator) coordinates. The Z data might be topographic elevation, water depth, chemical concentration, temperature, or any other quantity amenable to mapping.

Data files can be created in the Surfer worksheet, a text editor, or any program that can produce files in one of the supported file formats. Regardless of the program used to create your data files, you must save the file on disk prior to performing any Surfer operation requiring a data file, including the gridding operation. Surfer reads data only from a data file in one of the recognized formats.

It is not necessary to open a data file in the worksheet in order to use the data file for a command (i.e. Grid | Data). If you want to view or alter the data in a data file, you can use the File | Open command to gain access to the worksheet data.

Surfer requires the use of decimal degree values when using Latitude and Longitude data.

XYZ Data Files

XYZ data files contain the raw data Surfer interprets to produce a grid file. Before you create a grid file in Surfer, you must create an XYZ data file. XYZ data files must be organized in column and row format. By default, Surfer expects the X data to be contained in column A, the Y data in column B, and the Z data in column C. However, the data can be placed in any order in any column.

Portions of two simple data files are shown below. The order of the data in the file is not important. These examples contain descriptive headers in Row 1 of each column. Such information is helpful but not required by Surfer to create a grid file. When text appears in Row 1 of a column, this text appears in list boxes in various Surfer dialogs as column titles. If a number resides in Row 1, it is not incorporated into the dialogs, and instead, the column heading (such as column B) is displayed.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.1</td>
<td>0</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>3.5</td>
<td>0</td>
<td>45</td>
</tr>
<tr>
<td>3</td>
<td>4.9</td>
<td>0</td>
<td>65</td>
</tr>
<tr>
<td>4</td>
<td>6.2</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>0</td>
<td>55</td>
</tr>
<tr>
<td>6</td>
<td>9</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>7</td>
<td>9</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>3</td>
<td>48</td>
</tr>
</tbody>
</table>

This is a simple XYZ data file.
Chapter 3 - Data Files and the Worksheet

### Missing Entries

Rows with non-numeric entries (empty cells or text) in any of the X, Y, or Z columns are excluded when performing various tasks, including gridding or transforming data in the worksheet. If there is no Z information for a particular XY location, you can leave the Z cell blank for that row. In the example shown here, there are two data records without Z values. These records are not considered during the gridding operation.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Longitude</td>
<td>Latitude</td>
<td>Elevation</td>
</tr>
<tr>
<td>2</td>
<td>-109</td>
<td>39.205</td>
<td>1464</td>
</tr>
<tr>
<td>3</td>
<td>-108.965</td>
<td>39.337</td>
<td>1524</td>
</tr>
<tr>
<td>4</td>
<td>-108.93</td>
<td>39.389</td>
<td>1385</td>
</tr>
<tr>
<td>5</td>
<td>-108.95</td>
<td>39.526</td>
<td>1583</td>
</tr>
<tr>
<td>6</td>
<td>-108.86</td>
<td>39.688</td>
<td>1445</td>
</tr>
<tr>
<td>7</td>
<td>-108.825</td>
<td>39.795</td>
<td>1371</td>
</tr>
<tr>
<td>8</td>
<td>-108.79</td>
<td>40.003</td>
<td>1371</td>
</tr>
</tbody>
</table>

This is another example of an XYZ data file with header information in row 1 of each column in the data file.

### Multiple Columns of Information for Additional Maps

Data files can contain up to one billion columns. Since you can specify the columns to be gridded, your X, Y, and Z values can occupy any three columns. This allows you to have columns containing other information particular to each point. The data file can contain several Z columns, so you can produce several contour maps using the same XY coordinates. For example, you might have concentrations of different contaminants at each sample location. All the contaminant concentration data can be placed in the same data file.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X Data</td>
<td>Y Data</td>
<td>Z Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.1</td>
<td>0</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9</td>
<td>3</td>
<td>48</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1.3</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4.7</td>
<td>1</td>
<td>66</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1.7</td>
<td>5.6</td>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2.5</td>
<td>3.6</td>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Blank Z column cells are ignored when gridding a data file.
This is an example of an XYZ data file containing several columns of Z data. You could use this file to create several different grid files, where each uses the same XY coordinates, but different Z data.

Additional Information in Data Files
Data files may contain information in addition to the X, Y, and Z values. For example, when posting data with the Home | New Map | Post command, additional columns can be used to specify the symbol, the rotation angle, the symbol color, labels, etc. The following is an example of such a data file. Columns A, B, and C contain the X, Y, and Z data used to produce a contour map of depth to the water table. Columns D, E, and F contain information used to create an overlaying post map.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Easting</td>
<td>Northing</td>
<td>Elevation</td>
<td>Symbol set: index</td>
<td>Color</td>
<td>Angle</td>
</tr>
<tr>
<td>2</td>
<td>0.1</td>
<td>0</td>
<td>90</td>
<td>Arial:65</td>
<td>Red</td>
<td>45</td>
</tr>
<tr>
<td>3</td>
<td>3.5</td>
<td>0</td>
<td>45</td>
<td>Arial:66</td>
<td>green</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>4.9</td>
<td>0</td>
<td>65</td>
<td>Arial:67</td>
<td>blue</td>
<td>170</td>
</tr>
<tr>
<td>5</td>
<td>6.2</td>
<td>0</td>
<td>40</td>
<td>GSI Default Symbols:4</td>
<td>purple</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>0</td>
<td>55</td>
<td>GSI Default Symbols:8</td>
<td>majestic</td>
<td>145</td>
</tr>
<tr>
<td>7</td>
<td>9</td>
<td>0</td>
<td>25</td>
<td>GSI Default Symbols:14</td>
<td>Red</td>
<td>22</td>
</tr>
</tbody>
</table>

A data file used to create a post map or a classed post map can contain several columns of data. Each column can have a different effect on the posted data points.

Data as Numbers or Text
Worksheet data are in one of two forms: numbers or text. Grid file creation, statistics, post maps, and other operations require data as numbers. Text data (even if it contains numeric digits) can be used for labels in Surfer, but it cannot be used to create grids or in any operation requiring numbers.

Numbers can consist of digits (0 - 9), decimal points ( . ), the letters "e," "d," "E," or "D" (indicating an exponent), and the plus (+) or minus (-) sign. If you type any characters other than these when entering a number (or type any of the special characters more than once), Surfer automatically converts the cell entry to text. For example, if your longitude data appears as 104.5 W in a worksheet cell, it is interpreted as text and cannot be used to grid data. To successfully read this data, use the -104.5 format to indicate a location 104.5 degrees west of the prime meridian. If a number has if formatted as text and should be formatted as a number, highlight the cell or group of cells to select them and click the Text to Number command.

You can also convert numeric data to text by typing a single quotation mark ( ' ) in front of the number. Surfer does not place the single quotation in the worksheet cell, however the single quotation is visible in the Active Cell Edit Box.

By default, numeric data is right justified in a cell, and text is left justified. Cell entries, whether numeric or text, can be justified by specifying the desired alignment using the options on the Alignment page of the Format Cells dialog. Use the Text to Number command to remove text formatting.
Notice that column B is left aligned. This means the numbers are formatted as text. When a cell is highlighted, an apostrophe appears in the active cell edit box, also indicating that the number is formatted as text.

### Data File Formats

**Surfer** can import and export data in several data file formats. A variety of commands in the plot document, worksheet document, and grid node editor can be used to import and export data. The commands are summarized below:

#### Import Data File Formats
- **File | Import** in the plot document
- **Data | Edit | Merge** in the worksheet document
- **File | Open** in the plot, worksheet, or grid editor

#### Export Data File Formats
- **File | Export** in the plot document
- **File | Save As** in the plot document
- **Grids | Edit | Convert** in the plot document
- **File | Save As** in the grid editor
- **File | Save As** in the worksheet document

### Date/Time Formatting

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

#### Using Date/Time Formatting

To use dates and times in **Surfer**, the data need to be formatted as dates and times. One way to format data in **Surfer** is to use the worksheet. The worksheet can be accessed with the **File | New | Worksheet** or **File | Open** command. Highlight the column containing dates and times and select **Data | Format | Format Cells** to set the column as date/time in the worksheet. On the **Number** tab, select **Date/time** as the Type. Next, type the appropriate **Date/Time format** option, or click the **...** button and select or create a date/time format in the **Date/Time Format Builder** dialog.

Once the formatting is set to date/time, you can use the date/time information just as you would use numbers in **Surfer**:
- you can create a **post map** of the data using date/time values
• you can set the map limits using date/time values
• you can grid date/time values

Date/time information can also be used as labels anywhere in the map layer or as axis tick labels.

Date/Time formats are made of combinations of year, month, day, hours, minutes, seconds, BC/AD or BCE/CE designation, and AM/PM designation. Years are shown as yy or yyyy. Months are shown as M, MM, MMM, MMMM, or MMMMMM. Days are shown as d, dd, ddd, or dddd. Hours are shown as h, hh, H, HH, or [h]. Minutes are shown as m, mm, or [mm]. Seconds are shown as ss, ss.0, ss.00, ss.000, ss.0000, or [ss]. AM/PM designation is shown as tt or TT. BC/AD designation is shown as gg or GG. BCE/CE designation is shown as g, G, ggg, or GGG. See the Date Time Formats help topic for examples of date/time formats.

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 Surfer's worksheet, you can make the serial numbers appear as dates by using Data | 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 Surfer.
• 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.
• The year 0 is defined, according to the ISO 8601:2004 standard.
• 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.
• 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.

Working with Date/Time Values
Date/time values can be displayed as labels on axes, map layers, and used in setting limits on maps. Below are some methods available to work with date/time formats.

Formatting Data as Date/Time
To format cells in the worksheet as date/time, open the worksheet and select all of the cells that should be date/time format. Click the Data | Format | Format Cells command. In the Format Cells dialog, select Date/time as the Type and type the date/time format string into the Date/Time format field. Click OK and the selected cell is formatted as date/time. Alternatively, click the button to create the date/time format in the Date/Time Format Builder dialog. Save to a format, such as an Excel file, that accepts date/time formats to retain the date/time format.
Gridding Date/Time Values
Any worksheet column containing numbers, dates, or times can be used for gridding. When using date/time formats for any of the Data Columns, the values are stored in the grid as numbers, not in date/time format. To display date/time formats on the map, select the appropriate map part (axis, map layer, or map) and set the date/time label format.

Formatting Axes to Display Date/Time
Any axis can be changed to display dates or times for axis labels. To display date or time labels, click on the axis to select it. In the Properties window, click on the General tab. In the Labels section in the Label Format section, change the Type to Date/time. Then, set the Date/Time format to the desired label formats.

Formatting Contour Maps to Display Date/Time Labels
Any contour map label can be changed to display dates or times for axis labels. To display date or time labels, click on the contour map layer to select it. In the Properties window, click on the Levels tab.

For simple or logarithmic level methods: In the Labels section in the Label Format section, change the Type to Date/time. Then, set the Date/Time Format to the desired label formats.

For advanced level methods: Click the Edit Levels button next to the Contour levels command. In the Levels for Map dialog, click the Label button. Click the Format button to open the Label Format dialog. Change the Type to Date/Time. Then, set the Date/Time Format to the desired label formats.

Click OK in all dialogs and the labels update.

Formatting Post or Classed Post Maps to Display Date/Time Labels
Any post map or classed post map label can be changed to display dates or times for axis labels. To display date or time labels, click on the post map layer or classed post map layer to select it. In the Properties window, click on the Labels tab. In the Label Set 1 section, set the Worksheet column to the column that contains the date/time values. In the Label Format section, change the Type to Date/time. Then, set the Date/Time Format to the desired label formats.

Setting Map Limits with Date/Time
When using date/time formats for any of the axis labels, the minimum and maximum on the Limits tab are entered in date/time format. To change the map limits, click on the Map object to select it. In the Properties window, click on the Limits tab. Highlight the existing date/time value in any of the xMin, xMax, yMin, or yMax boxes and enter the minimum or maximum date/time value. For instance, 02/02/2014 12:00:00 AM can be entered into the xMin option. The map limits must be entered in M/d/yyyy hh:mm:ss TT format.

Grid Residuals
The Grids | Calculate | Residuals command takes an existing grid and an X,Y,Z column from a data file and computes the residuals at the locations specified in the data file. The residual value is written to a new column in the worksheet. If the input Z values in the worksheet are in date/time format, then the residuals are the difference between the Z grid value and the input date/time Z value. This is not a date/time format, but is rather the difference between the times, signifying a time duration. The units are days.

Date Time Formats
Date and time formats can be set from the worksheet, from labels, and from axes. In addition, date and time formats can be used for data columns when creating post maps or when gridding data. Date and time options are case sensitive.
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.

Date/Time formats are made of combinations of locale, year, month, day, hours, minutes, seconds, BC/AD or BCE/CE designation, and AM/PM designation. Years are shown as yy or yyyy. Months are shown as M, MM, MMM, MMMM, or MMMMM. Days are shown as d, dd, ddd, or dddd. Hours are shown as h, hh, H, HH, or [h]. Minutes are shown as m, mm, or [mm]. Seconds are shown as ss, ss.0, ss.00, ss.000, or [ss]. AM/PM designation is shown as tt or TT. BC/AD designation is shown as gg or GG. BCE/CE designation is shown as g, G, ggg or GGG.

To add new date/time designations, use any combination of the following codes:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>d</td>
<td>Single digit day, excluding leading zero</td>
</tr>
<tr>
<td>dd</td>
<td>Double digit day, including leading zero</td>
</tr>
<tr>
<td>ddd</td>
<td>Shortened day of week name</td>
</tr>
<tr>
<td>dddd</td>
<td>Full day of week name</td>
</tr>
<tr>
<td>M</td>
<td>Single digit month, excluding leading zero</td>
</tr>
<tr>
<td>MM</td>
<td>Double digit month, including leading zero</td>
</tr>
<tr>
<td>MMM</td>
<td>Shortened month name</td>
</tr>
<tr>
<td>MMMM</td>
<td>Full month name</td>
</tr>
<tr>
<td>MMMM</td>
<td>First letter of month name</td>
</tr>
<tr>
<td>yy</td>
<td>Two digit year</td>
</tr>
<tr>
<td>yyyy</td>
<td>Full year</td>
</tr>
<tr>
<td>g</td>
<td>Before Common Era designator - Includes space and bce or nothing if ce, lower case</td>
</tr>
<tr>
<td>gg</td>
<td>BC/AD designator - Includes space and bc or ad, lower case</td>
</tr>
<tr>
<td>ggg</td>
<td>Before Common Era designator - Includes space and bce or ce, lower case</td>
</tr>
<tr>
<td>G</td>
<td>Before Common Era designator - Includes space and BCE or nothing if CE, upper case</td>
</tr>
<tr>
<td>GG</td>
<td>BC/AD designator - Includes space and BC or AD, upper case</td>
</tr>
<tr>
<td>GGG</td>
<td>Before Common Era designator - Includes space and BCE or CE, upper case</td>
</tr>
<tr>
<td>h</td>
<td>Single digit hours - 1-12, excluding leading zero</td>
</tr>
<tr>
<td>hh</td>
<td>Double digit hours - 01-12, including leading zero</td>
</tr>
<tr>
<td>H</td>
<td>Hours - 0-23 military, excluding leading zero</td>
</tr>
<tr>
<td>HH</td>
<td>Hours - 00-23 military, including leading zero</td>
</tr>
<tr>
<td>[h]</td>
<td>Hours portion of total time, excludes leading zeros</td>
</tr>
<tr>
<td>m</td>
<td>Minutes - 0-60, excluding leading zero</td>
</tr>
<tr>
<td>mm</td>
<td>Minutes - 00 to 60, including leading zero</td>
</tr>
<tr>
<td>[mm]</td>
<td>Minutes portion of total time, includes leading zeros</td>
</tr>
<tr>
<td>ss</td>
<td>Seconds - 0-60, rounded to the nearest second</td>
</tr>
<tr>
<td>ss.0</td>
<td>Seconds - 0-60, rounded to the nearest tenth of a second</td>
</tr>
<tr>
<td>ss.00</td>
<td>Seconds - 0-60, rounded to the nearest hundredth of a second</td>
</tr>
<tr>
<td>ss.000</td>
<td>Seconds - 0-60, rounded to the nearest millisecond</td>
</tr>
<tr>
<td>ss.0000</td>
<td>Seconds - 0-60, maximum precision</td>
</tr>
<tr>
<td>[ss]</td>
<td>Seconds portion of total time, includes leading zeros</td>
</tr>
<tr>
<td>tt</td>
<td>AM or pm designator, lower case</td>
</tr>
<tr>
<td>TT</td>
<td>AM or PM designator, upper case</td>
</tr>
</tbody>
</table>
escape character - output next character verbatim

'...' output ALL characters between single quotes verbatim, including escape character

[$-xxxx]$ xxxx is an up to four hex digit representation of a locale ID

Custom Date/Time Example

<table>
<thead>
<tr>
<th>Date Formats</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>mm/dd/yy h:mm:ss tt</td>
<td>04/14/09 6:45:44 PM</td>
<td>Month double digits, Day double digits, Year double digits, Hour in standard format, Minutes, Seconds and AM/PM designation</td>
</tr>
</tbody>
</table>

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.

The tables below show many examples of date/time format strings.
<table>
<thead>
<tr>
<th>Date Format</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMM-yyy</td>
<td>Sep-1998</td>
<td>Shortened month name, full year, separated with -</td>
</tr>
<tr>
<td>MMMM-yy</td>
<td>September-98</td>
<td>Full month name, two digit year, separated with -</td>
</tr>
<tr>
<td>MMMM-yyyy</td>
<td>September-1998</td>
<td>Full month name, full year, separated with -</td>
</tr>
<tr>
<td>MM-dd-yyyy</td>
<td>09-07-98</td>
<td>Double digit month and day, two digit year, separated with -</td>
</tr>
<tr>
<td>yyyy</td>
<td>1998</td>
<td>Full year</td>
</tr>
<tr>
<td>yyyy gg</td>
<td>1998 ad</td>
<td>Full year with lowercase bc/ad designation</td>
</tr>
<tr>
<td>yyyy GGG</td>
<td>1998 CE</td>
<td>Full year with uppercase BCE/CE designation</td>
</tr>
<tr>
<td>yyy</td>
<td>98</td>
<td>Two digit year</td>
</tr>
<tr>
<td>MMMMMMM</td>
<td>S</td>
<td>First letter of month name</td>
</tr>
<tr>
<td>MMMMM</td>
<td>September</td>
<td>Full month name</td>
</tr>
<tr>
<td>MMM</td>
<td>Sep</td>
<td>Shortened month name</td>
</tr>
<tr>
<td>MM</td>
<td>09</td>
<td>Double digit month</td>
</tr>
<tr>
<td>M</td>
<td>9</td>
<td>Single digit month</td>
</tr>
<tr>
<td>MMMMM-yy</td>
<td>S-98</td>
<td>First letter of month name, two digit year, separated with -</td>
</tr>
<tr>
<td>MMMM-d</td>
<td>Sep-7</td>
<td>Shortened month name, single digit day, separated with -</td>
</tr>
<tr>
<td>M/d</td>
<td>9/7</td>
<td>Single digit month and day, separated with /</td>
</tr>
<tr>
<td>dddd</td>
<td>Monday</td>
<td>Full day of week name</td>
</tr>
<tr>
<td>ddd</td>
<td>Mon</td>
<td>Shortened day of week name</td>
</tr>
<tr>
<td>dd</td>
<td>07</td>
<td>Double digit day</td>
</tr>
<tr>
<td>d</td>
<td>7</td>
<td>Single digit day</td>
</tr>
<tr>
<td>d/M/yy</td>
<td>7/9/98</td>
<td>Single digit day and month, two digit year, separated with /</td>
</tr>
<tr>
<td>d.M.yy</td>
<td>7.9.98</td>
<td>Single digit day and month, two digit year, separated with .</td>
</tr>
<tr>
<td>dd/MM/yy</td>
<td>07/09/98</td>
<td>Double digit day and month, two digit year, separated with /</td>
</tr>
<tr>
<td>dd/MM/yyyy</td>
<td>07/09/1998</td>
<td>Double digit day and month, full year, separated with /</td>
</tr>
<tr>
<td>yy/MM/dd</td>
<td>98/09/07</td>
<td>Two digit year, double digit month and day, separated with /</td>
</tr>
<tr>
<td>yyyyy-MM-dd</td>
<td>1998-09-07</td>
<td>Full year, double digit month and day, separated with -</td>
</tr>
</tbody>
</table>

**Time Formats**

All rows below use the time 2:45:44.12 PM for the Example.

<table>
<thead>
<tr>
<th>Date/Time Code</th>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(None)</td>
<td></td>
<td>Time not displayed</td>
</tr>
<tr>
<td>h:mm tt</td>
<td>2:45 PM</td>
<td>Hour in 0-12 (standard format), two digit Minutes 00 to 60, then a space and AM or PM</td>
</tr>
<tr>
<td>h:mm</td>
<td>14:45</td>
<td>Hour in 0-23 (military time), two digit Minutes 00 to 60</td>
</tr>
<tr>
<td>hh:mm</td>
<td>14:45</td>
<td>Two digit Hour 00-23 (military time), two digit Minutes 00 to 60</td>
</tr>
</tbody>
</table>
Chapter 3 - Data Files and the Worksheet

<table>
<thead>
<tr>
<th>h:mm:ss tt</th>
<th>2:45:44 PM</th>
<th>Hour in 0-12 (standard format), two digit Minutes 00 to 60</th>
</tr>
</thead>
<tbody>
<tr>
<td>h:mm:ss</td>
<td>14:45:44</td>
<td>Hour in 0-23 (military time), two digit Minutes 00 to 60</td>
</tr>
<tr>
<td>hh:mm:ss</td>
<td>14:45:44</td>
<td>Two digit Hour 00-23 (military time), two digit Minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>00 to 60, two digit Seconds 00 to 60</td>
</tr>
<tr>
<td>m:ss</td>
<td>45:44</td>
<td>Single digit Minutes 0 to 60, two digit Seconds 00 to</td>
</tr>
<tr>
<td>mm:ss</td>
<td>45:44</td>
<td>60</td>
</tr>
<tr>
<td>m:ss.0</td>
<td>45:44.1</td>
<td>Two digit Minutes 00 to 60, two digit Seconds 00 to 60,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fractional seconds rounded to the nearest tenth of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a second</td>
</tr>
<tr>
<td>mm:ss.0</td>
<td>45:44.1</td>
<td>Two digit Minutes 00 to 60, two digit Seconds 00 to 60,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fractional seconds rounded to the nearest tenth of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a second</td>
</tr>
<tr>
<td>h:mm:ss.000</td>
<td>14:45:44.12</td>
<td>Hour in 0-23 (military time), two digit Minutes 00 to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60, two digit Seconds, 00 to 60, fractional seconds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>with full precision</td>
</tr>
<tr>
<td>m:ss.000</td>
<td>45:44.12</td>
<td>Single digit Minutes 0 to 60, two digit Seconds 00 to</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60, fractional seconds with full precision</td>
</tr>
<tr>
<td>mm:ss.000</td>
<td>45:44.12</td>
<td>Two digit Minutes 00 to 60, two digit Seconds 00 to 60,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>fractional seconds with full precision</td>
</tr>
<tr>
<td>[h]:mm:ss</td>
<td>865094:45:44</td>
<td>Total hours (day value plus hour value), two digit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minutes 00 to 60, two digit Seconds 00 to 60</td>
</tr>
</tbody>
</table>

Example Explanation: Date value 865080 = September 7, 1998
Hour value = 14, added to 865080 = 865094

Worksheet Document
Worksheet windows are a view of the data file and are designed to display, edit, enter, and save data. The worksheet windows have several useful and powerful editing, transformation, and statistical operations available. In addition, a coordinate system can be assigned to the data file. Several import and export options are available for opening data files from other spreadsheet programs. The components of the worksheet window are displayed below.

Worksheet Commands
The worksheet commands include commands on the following tabs:

- **File**
  - Open and save files, import or export data, print, and set options and defaults
- **Home**
  - Contains clipboard and undo commands
- **Grids**
  - Perform grid operations
- **View**
  - Controls the display of status bar and windows and resets window positions
- **Data**
  - Edit, find, format data in the worksheet. Manipulate, transform, and perform calculations with worksheet data. Assign or project coordinates. Track the cursor between the plot, worksheet, and grid windows.

Not all of the **File**, **Home**, **Grids**, and **View** commands are available in the worksheet view.

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 node editor 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.

Worksheet Window

The image below displays the parts of the worksheet document.

![Worksheet Document](image)

*This is the **Surfer** worksheet document with the **Contents** and **Properties** windows in auto hide mode on the left, and the plot document and worksheet tabs at the top of the worksheet.*

Opening a Worksheet Window

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

To open a blank worksheet window:

- Click the **File | New | Worksheet** command in the plot document, **grid editor**, or **worksheet document**.
- Click the **button in the toolbar.
Chapter 3 - Data Files and the Worksheet

- Press the CTRL + W keyboard command.

To view worksheet data:
- Click the File | Open command in the plot document, grid node editor, or worksheet document and then select a data file.
- Click the button in the toolbar. In the Open dialog, select a data file.
- Select the File | Open or File | Import command in the worksheet and then select a data file.
- If there is an open worksheet window, return to it at any time by clicking the desired worksheet tab.

To enter and modify worksheet data:
See Working with Worksheet Data for more information.

Worksheet Window
To enter data in a worksheet, click the File | Open command to open an existing data file or click the File | New | Worksheet command to create a blank worksheet. The components of the worksheet window are discussed below.

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

<table>
<thead>
<tr>
<th>Component Name</th>
<th>Component Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Column Letters</td>
<td>The letter that identifies a column of the worksheet.</td>
</tr>
<tr>
<td>Row Numbers</td>
<td>The number that identifies a row of the worksheet.</td>
</tr>
<tr>
<td><strong>Active Cell</strong></td>
<td>The cell 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.</td>
</tr>
<tr>
<td><strong>Active Cell Location</strong></td>
<td>The location of the active cell, specified by column letter and row number.</td>
</tr>
<tr>
<td><strong>Active Cell Edit Box</strong></td>
<td>The box displaying the data or text contained in the active cell. Data typed into an empty cell appears in both the edit box and the active cell.</td>
</tr>
<tr>
<td>Worksheet Name</td>
<td>The name of the data file displayed in the worksheet or the worksheet number prior to saving.</td>
</tr>
<tr>
<td>Select Entire Worksheet Button</td>
<td>The button used to select all cells in the worksheet. Located in the top left corner of the worksheet.</td>
</tr>
</tbody>
</table>
**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.

![The column and row label bars are highlighted in this example.](image)

**Active Cell**

The active cell is displayed with a heavy border surrounding the cell. The contents of this cell are displayed in the cell edit box. You can enter or edit data in the active cell. To edit existing data, activate the desired cell and press the F2 key or highlight the information in the cell edit box.

Special Key Functions when editing the active cell include the following:

<table>
<thead>
<tr>
<th>Keyboard Command</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ESC cancels edit mode and restores the original contents of the active cell.

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.

ARROWS (left and right) 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.

ARROWS (up and down) store the contents of the cell edit box in the active cell and move the active cell above or below.

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.

PAGE UP and PAGE DOWN store the contents of the cell edit box in the active cell and move one page up or down.

TAB and SHIFT+TAB store the contents of the cell edit box in the active cell and move the active cell to the right or 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.

<table>
<thead>
<tr>
<th>C5</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>1</td>
<td>Easting</td>
</tr>
<tr>
<td>2</td>
<td>0.1</td>
</tr>
<tr>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>4</td>
<td>4.9</td>
</tr>
<tr>
<td>5</td>
<td>6.2</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

This example shows the active cell as cell C5. The name of the active cell "C5" 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:

<table>
<thead>
<tr>
<th>Keyboard Command</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESC</td>
<td>ESC cancels edit mode and restores the original contents of the active cell.</td>
</tr>
<tr>
<td>ENTER</td>
<td>ENTER stores the contents of the cell edit box and then moves the active cell down one cell.</td>
</tr>
<tr>
<td>CTRL+ENTER</td>
<td>CTRL+ENTER completes the entry and keeps the current cell active.</td>
</tr>
<tr>
<td>ARROWS (left and right)</td>
<td>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.</td>
</tr>
<tr>
<td>ARROWS (up and down)</td>
<td>Up and down ARROWS store the contents of the cell edit box in the active cell and move the active cell above or below.</td>
</tr>
<tr>
<td>DELETE</td>
<td>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.</td>
</tr>
<tr>
<td>BACKSPACE</td>
<td>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.</td>
</tr>
<tr>
<td>PAGE UP and PAGE DOWN</td>
<td>PAGE UP and PAGE DOWN store the contents of the cell edit box in the active cell and move one page up or down.</td>
</tr>
<tr>
<td>TAB and SHIFT+TAB</td>
<td>TAB and SHIFT+TAB store the contents of the cell edit box in the active cell and move the active cell to the right or left.</td>
</tr>
</tbody>
</table>

Select Entire Worksheet

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

There are three ways to enter data into the worksheet. Data are entered into the worksheet by using File | Open and opening a data file, by typing data directly into the worksheet, or by copying the data from another application and pasting it into the worksheet. Use the Data menu commands to sort the data, filter the data, view statistics, transform the data using mathematical functions, assign default columns for coordinate data, assign a coordinate system to the data, and project coordinates.

There are two basic modes in the worksheet. Normal mode is when the active cell can be moved throughout the worksheet, and edit mode allows the contents of a single cell to be edited in the active cell edit box. Only one mode may be active at a given time. ESC, ENTER, or clicking on another cell can be used to exit edit mode and return to normal mode.

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 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 the ENTER, Up or Down ARROWS, TAB, SHIFT+TAB, PAGE UP, or PAGE DOWN keys causes 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.

<table>
<thead>
<tr>
<th>Keyboard Command</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARROW keys (Up, Down, Left, Right)</td>
<td>The ARROWS move the active cell to an adjacent cell.</td>
</tr>
<tr>
<td>PAGE UP/PAGE DOWN</td>
<td>Press the PAGE UP or PAGE DOWN to move the active cell up or down by the number of rows visible in the window.</td>
</tr>
</tbody>
</table>
### HOME
Press HOME to move the active cell to the first occupied cell in the current column. Press HOME again to move the active cell to the top row in the current column.

### END
Press END to move the active cell to the last occupied row in the current column. Press END again to move the active cell to the bottom row of the worksheet.

### ENTER
Press ENTER to move the active cell down one row and end "edit mode."

### TAB
Press TAB to move the active cell right one column and end "edit mode."

### SHIFT + ENTER
Press SHIFT+ENTER to move the active cell up one row and end "edit mode."

### SHIFT + TAB
Press SHIFT+TAB to move the active cell left one column and end "edit mode."

### CTRL+HOME
Press CTRL+HOME to move the active cell to the top cell of the left most column in the worksheet (A1).

### CTRL+END
Press CTRL+END to move the active cell to the bottom occupied row of the last occupied column in the worksheet.

### CTRL+LEFT ARROW
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.

### CTRL+RIGHT ARROW
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.

### CTRL+UP ARROW
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.

### CTRL+DOWN ARROW
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.

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

Opening Data Files
When you create a grid file or use another command that requires data, you do not need to open the data into the worksheet first. However, the worksheet is available if you would like to view or edit your data. The File | Open command loads a data file into a new worksheet.

If the worksheet already contains data, additional data can be imported into the worksheet using the File | Import command. The contents of the new file are merged into the worksheet at the active cell so it is imperative that the cell be positioned at the edge of the existing data. Any cells in the existing worksheet that lie to the right and below the active cell will be overwritten with the contents of the merging file.

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

Worksheet Input Modes
The worksheet has several special input modes that tracks the mouse position:
- Drag-Select Mode - for selecting cells with the mouse
- Drag-Row-Height Mode - for adjusting row heights with the mouse
- Drag-Column-Width Mode - for adjusting column widths with the mouse

Pressing the ESC key before releasing the mouse button cancels the mouse-tracking mode.

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,
- perform a transform function,
- sort the selected cells,
- compute statistics for selected cells, or to
- set column properties for several columns via the column width, row height, and cell format commands.

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. Alternatively, the PAGE UP, PAGE DOWN, HOME, and END keys may also be used to deselect the cells.
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, discontinuous 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.).

<table>
<thead>
<tr>
<th>To Select</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single cells</td>
<td>Click in the cell to select it, or use the arrow keys to select a cell. The selected cell will have a thick outline around it.</td>
</tr>
<tr>
<td>A rectangular block of cells</td>
<td>Move the active cell to one corner of the block. While holding down the SHIFT key, use the movement keys to position the opposite corner of the block. The movement keys include the ARROW keys, PAGE UP, PAGE DOWN, HOME, and END, but not TAB and SHIFT+TAB. When the block has been sized, release the SHIFT key. To resize the block, see the instructions below.</td>
</tr>
<tr>
<td>Several adjacent rows</td>
<td>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.</td>
</tr>
<tr>
<td>Several adjacent columns</td>
<td>Select the first or last column. Then, while holding down the SHIFT key, use the right and left ARROW keys.</td>
</tr>
</tbody>
</table>

### Resize the 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, left-click 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.).

<table>
<thead>
<tr>
<th>To Select</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single cells</td>
<td>Click the left mouse button on the cell. The cell will have a thick outline around it.</td>
</tr>
<tr>
<td>A rectangular block of cells</td>
<td>Move the active cell to one corner of the block. Click and hold the left mouse button, and drag it to the opposite corner of the block. Then release the mouse button.</td>
</tr>
<tr>
<td>An entire row</td>
<td>Click the mouse on the row label.</td>
</tr>
<tr>
<td>Several adjacent rows</td>
<td>Click and hold the mouse on the first row label and drag it to the last row. Make sure the cursor is a normal arrow cursor not the double arrow cursor used for selecting column dividing lines. To deselect a single row from a multiple row selection, hold CTRL and click the row label.</td>
</tr>
<tr>
<td>An entire column</td>
<td>Click the mouse on the column label.</td>
</tr>
<tr>
<td>Several adjacent columns</td>
<td>Click and hold the mouse on the first column label and drag it to the last column. Make sure the cursor is a normal arrow cursor not the double arrow cursor used for selecting column dividing lines. To deselect a column from a multiple column selection, hold CTRL and click the column label.</td>
</tr>
<tr>
<td>The entire worksheet</td>
<td>Click on the small box above the row labels and to the left of the column label bar.</td>
</tr>
</tbody>
</table>

The worksheet will scroll 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, left-click anywhere within the worksheet or move the active cell with an arrow key or other movement key.

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.

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 Data | Format | Column Width or Data | Format | Row Height commands can also be used to set column widths or row heights.
Move the cursor to the label bar near the dividing line until the cursor changes to a between columns, and a between rows. The cursor must be within approximately a character's width of the dividing line and it must be on the label bar. Click and hold the left mouse button and drag the dividing line.

![Image showing cursor used to change column width](image1)

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

![Image showing cursor used to change row height](image2)

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

### 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 Format Menu
Columns and rows can also be hidden with the Data | Format | Column Width and Data | Format | Row Height commands. Select the columns or rows to hide, click the Data | Format | Column Width or Data | Format | Row Height command, 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 at 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 dragging the dividing line. 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 will be 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 will select the line for column D. (If the cursor is to the left of the dividing line, then the dividing line for column A will be selected.) Drag the vertical dividing line to the right to unhide column D. Repeat for columns C and B.

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

<table>
<thead>
<tr>
<th>Codes</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>##########</td>
<td>number will not fit in the column - the column must be wider for the number to be shown</td>
</tr>
<tr>
<td>#N/A</td>
<td>value cannot be computed (for example, not enough data to calculate a statistic)</td>
</tr>
<tr>
<td>#DIV/0!</td>
<td>an attempt to divide-by-zero was made in performing a calculation</td>
</tr>
<tr>
<td>#ERROR</td>
<td>a value could not be computed (for example, square root of a negative number)</td>
</tr>
<tr>
<td>#OVERFLOW</td>
<td>the value is too large for the worksheet (largest absolute value is about 1.797E+308)</td>
</tr>
<tr>
<td>1.# INF</td>
<td>the value is too large for the worksheet (i.e., &quot;infinite&quot; value)</td>
</tr>
<tr>
<td>1.# IND</td>
<td>numeric value is indefinite (usually the result of performing a calculation with an infinite value or attempting to divide by zero)</td>
</tr>
</tbody>
</table>

Worksheet 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
- Maximum numeric precision: 15 digits (Counting the digits before and after the decimal place)
- Maximum numeric resolution: 2.22E-16 (The smallest detectable difference between two numbers)
- Maximum absolute value: 1.79769E+308 (The largest value that can be represented)
- Minimum absolute value: 2.22507E-308 (The smallest value that is different from zero)
- Double precision floating-point numbers can only represent approximately 15 significant decimal digits.
- Approximate memory requirements for unformatted numeric data: 10.5 bytes per cell + 24 bytes per column

Example 1

10,000 rows of numbers in 3 columns

30,000 cells x 10.5 bytes/cell = 315,000 bytes (308 Kbytes)
3 columns x 24 bytes/column = 72 bytes
TOTAL MEMORY NEEDED (in addition to memory needed to run the program): 308 Kbytes

Example 2

3 rows of numbers in 10,000 columns

30,000 cells x 10.5 bytes/cell = 315,000 bytes (308 Kbytes)
10,000 columns x 24 bytes/column = 240,000 bytes (234 Kbytes)
TOTAL MEMORY NEEDED (in addition to memory needed to run the program): 542 Kbytes

Paste

Click the **Home | Clipboard | Paste** command or press CTRL+V on the keyboard to paste the clipboard contents into the current document. The objects to be pasted must first be placed in the
clipboard using the Cut or Copy commands of Surfer or some other application. The clipboard contents remain on the clipboard until something new is cut or copied to the clipboard.

Worksheet
In the worksheet, the upper left corner of the pasted data is placed in the active cell. Any cells in the existing worksheet that lie to the right of and below the active cell will be overwritten with the contents of the pasted data. The following rules are used to paste into the worksheet:

- Only the TAB character is recognized as a column separator. Spaces, commas, semi-colons, etc. are included in a text cell.
- The RETURN character is recognized as the row separator.
- Numbers paste as number values. The period can always be used as a decimal separator, and the system locale determines any other decimal separator. For example if the system locale uses a comma as the decimal separator, then both 123.456 and 123,456 are pasted as the number 123,456.
- Mixed text and numbers paste as text.
- Dates and/or times will paste as date values in a wide variety of date/time formats. Ambiguous dates are determined by the system locale setting. If dates are not pasted correctly, consider using Paste Special and the Locale settings in the Data Import Options dialog.

Pasting a single cell's contents across multiple cells
A single cell's contents can be pasted into multiple cells by coping the cell, selecting a block of cells, and using the Paste command. Each cell in the selection is populated with the clipboard contents when this operation is performed. If more than one cell is copied, then the copied cells are only pasted once.

The multiple paste operation will not be performed for an entire row, entire column, or across multiple selections. When an entire row or column is selected, only the first cell in the row or column will receive the pasted content. If you attempt to paste in multiple selections an error message will be displayed.

Plot
In the plot window, the clipboard contents are pasted in the center of the window. The pasted contents are automatically selected, and can be dragged to a new location. Alternatively, change the position or size of the selected object with the Position/Size group.

Paste Special
When data are copied to the clipboard, special formatting information is also copied. The Paste Special dialog determines the format in which the contents are pasted into the worksheet. The Paste Special command can also be used to remove text formatting.

Paste Special Dialog
Click the Home | Clipboard | Paste | Paste Special command in the worksheet to open the Paste Special dialog.
Select a paste special format in the Paste Special dialog. This example shows options after copying Surfer worksheet data and using paste special.

The clipboard formats displayed may vary depending on the original location of the information being copied. For example, data copied from the Surfer 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.

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

**Text [Clipboard Text]**
The Text [Clipboard Text] format is unformatted text.
Show Import Options
When Unicode Text [Clipboard Text] or Text [Clipboard Text] is selected, the Show Import Options option is available. Check the box to open the Data Import Options dialog before importing the data. The Data Import Options dialog is useful when pasting data with comma, period, semicolon, or other column delimiters; fixed-width column data; ambiguous date/time formatted data; and data from different locales.

Data Import Options
If a file is in an ASCII text format with an unrecognized file extension, the Data Import Options dialog appears when opening the file. Choose the Delimiters used in the file (Tab, Comma, Semicolon, Space, or Other), and the Text Qualifiers used in the file (Double Quote or Single Quote).

Data Import Options Dialog
The Data Import Options dialog may appear when importing tabular data from delimited text files (i.e. .DAT, .CSV, .TXT). These file formats are assumed to have one record per line in which each record contains a fixed number of numeric data fields.

The Data Import Options dialog allows you to specify import options.
Field Format
Specify the format of the input fields in the Field Format group. The options are Delimited or Fixed Width.

Delimited
Choose Delimited (fields are separated by tabs or other characters) if the imported data uses delimiters (tab, semicolon, comma, space, other) to separate data fields. The Delimiters group is used to specify how the fields are separated if Delimited (fields are separated by tabs or other characters) is the selected Field Format.

Fixed Width
Choose Fixed Width (each field is a fixed number of characters wide) if the imported data uses a fixed width to separate data fields.

Start Import at Row
Specify the row number at which to start the data import in the Start import at row box. To change the first row to import, highlight the existing value and type a new value or click the buttons to increase or decrease the value. For example, a value of one will start the data import at row one. A value of five will start the data import at row five and ignore the data in rows one through four.

Delimiters
Choose the desired delimiters to be used during the import process by checking the box next to Tab, Comma, Semicolon, or Space. You may also enter a custom delimiter in the Other box. More than one delimiter may be checked.

Text Qualifiers
Check the box next to Double Quote or Single Quote in the Text Qualifiers group to indicate the correct qualifier to identify text values in the data file. Everything between the selected characters will be interpreted as a single value, and any delimiter characters between text qualifiers are ignored and treated as part of the text.

Double Quote
Check the box next to "Double Quote" to specify that everything between those marks should be interpreted as a single value, and any delimiter characters between any two quote characters are not treated as a delimiter.

For example, if Space is chosen as the delimiter and Double Quote is chosen as the text qualifier, the string "Aspen Park" is treated as a single data value due to the double quotes surrounding it, and the space delimiter between the words is treated as part of the value.

Single Quote
Check the box next to 'Single Quote' to specify that everything between those marks should be interpreted as a single value, and any delimiter characters between any two quote characters are not treated as a delimiter.

For example, if Space is chosen as the delimiter and Single Quote is chosen as the text qualifier, the string 'Aspen Park' is treated as a single data value due to the single quotes surrounding it, and the space delimiter between the words is treated as part of the value.

Skip Leading Spaces
Check the box next to Skip leading spaces to tell the software to ignore spaces that appear before initial text.
Treat Consecutive Delimiters as One
Check the box next to Treat consecutive delimiters as one to instruct the software to interpret any consecutive delimiters into a single delimiter rather than breaking to a new column for each consecutive delimiter.

Use Comma as Decimal Symbol
Check the box next to Use comma as decimal symbol to interpret every comma as the decimal symbol. The number 123,45 in the file would be displayed as 123.45 in the program worksheet with this option checked.

Preview
The parsed data are shown in the Preview section.

Encoding
The Encoding section allows the choice of Unicode data or ANSI data when importing or opening an ASCII data file. Unicode data is often referred to as international data. It would include character sets from Russia, Israel, China, Greece, Hungary, among others. After selecting Unicode, select the ANSI text translation [codepage] option that will read the data correctly. If the data does not appear correctly in the Preview window, the Encoding may be specified incorrectly.

ANSI encoding contains characters within the first 256 characters of a font. These are normally in English.

Locale
The locale section of the dialog contains options for determining date/time values. The Language (Country) setting determines which month names are interpreted as part of a date. For example, if German (Germany) is selected, "Oktober" will be recognized as a valid month name. English month names are always recognized as valid month names. The default Language (Country) is determined by the user locale set in the Windows Control Panel. To change the Language (Country), click the current option and select a language from the list.

The Date order option specifies the order in which dates are written in the data file. The date 02/03/04 is ambiguous and could be Month-Day-Year, Day-Month-Year, Year-Month-Day, etc. The Date order option ensures dates in the data file are imported correctly into Surfer. The default Date order is Auto. The standard date order for the Language (Country) setting is used when Date order is set to Auto. Specify the Date order for the data file import by clicking the current Date order selection and then selecting the desired Date order from the list. All six combinations of Day (D), Month (M), and Year (Y) are included in the Date order list.

OK or Cancel
Click OK to proceed with the import process. Click Cancel to close the dialog without importing the data set.

Copy
Click the Home | Clipboard | Copy command or press CTRL+C on the keyboard to copy the selected objects to the clipboard. The original objects remain in the window. Use this command to duplicate objects in a different location in the same window, or copy the objects into a different window or application. The copied objects can later be pasted with the Paste or Paste Special commands.

Only one set of data may be placed in the clipboard at a time. The next Cut or Copy command replaces the contents of the clipboard.
Cut
Click the Home | Clipboard | Cut command or press CTRL+X on the keyboard to move the selected objects to the clipboard. This deletes the selected objects from the file after copying them to the clipboard. Cut objects can later be pasted with the Paste or Paste Special commands.

Only one set of data may be placed in the clipboard at a time. The next Cut or Copy command replaces the contents of the clipboard.

Data Tab Commands
The Data tab contains commands for editing the cell and worksheet, finding and replacing cell contents, formatting the cells, manipulating data, and assigning or projecting coordinate systems. The Data tab is only available when viewing a worksheet.

The worksheet ribbon Data tab has the following commands:

<table>
<thead>
<tr>
<th>Command</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
<td>Remove the selected cells</td>
</tr>
<tr>
<td>Merge</td>
<td>Combines a worksheet file with the existing worksheet</td>
</tr>
<tr>
<td>Insert</td>
<td>Displace selected cells and insert new cells into the worksheet</td>
</tr>
<tr>
<td>Delete</td>
<td>Delete selected worksheet cells and move rows or columns</td>
</tr>
<tr>
<td>Find</td>
<td>Find a particular word or phrase in the worksheet</td>
</tr>
<tr>
<td>Find Next</td>
<td>Find the next occurrence of the word or phrase</td>
</tr>
<tr>
<td>Replace</td>
<td>Replace the word or phrase with alternate text</td>
</tr>
<tr>
<td>Format Cells</td>
<td>Sets the numeric format, alignment, and background color for the selected cells</td>
</tr>
<tr>
<td>Column Width</td>
<td>Sets column widths for selected cells</td>
</tr>
<tr>
<td>Row Height</td>
<td>Sets row height for selected cells</td>
</tr>
<tr>
<td>Transform</td>
<td>Applies a mathematical transform to columns</td>
</tr>
<tr>
<td>Sort</td>
<td>Sorts selected cells</td>
</tr>
<tr>
<td>Spatial Filter</td>
<td>Spatially filters X, Y and optional Z coordinates</td>
</tr>
<tr>
<td>Statistics</td>
<td>Computes statistics on selected cells</td>
</tr>
<tr>
<td>Text to Number</td>
<td>Convert the text in selected cells to numbers</td>
</tr>
<tr>
<td>Transpose</td>
<td>Convert columns to rows and rows to columns</td>
</tr>
<tr>
<td>Assign XYZ Columns</td>
<td>Specifies the default columns for X, Y, and Z coordinate data</td>
</tr>
<tr>
<td>Assign Coordinate System</td>
<td>Specifies the existing coordinate system</td>
</tr>
<tr>
<td>New Projected Coordinates</td>
<td>Specifies the columns containing the source X, Y coordinates and target X, Y columns for a new coordinate system</td>
</tr>
<tr>
<td>DMS to DD</td>
<td>Convert DMS latitudes and longitudes to decimal degrees</td>
</tr>
<tr>
<td>Track Cursor</td>
<td>Track cursor location across plot, worksheet, and grid editor windows for a maps, data files, and grids.</td>
</tr>
</tbody>
</table>

Clear - Worksheet
Click the Data | Edit | Clear command, or press the DELETE key on the keyboard, to remove data from selected worksheet cells. The cells become empty when the data are removed. To shift the data from unselected cells into the selected cell locations, use the Delete command instead.
Merge - Worksheet Document

The **Data | Edit | Merge** command in the worksheet loads the contents of a data file into the existing worksheet. Select a file to import into the existing file in the **Import Data** dialog. The contents of the new file are merged 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 merging file.

Import Data Dialog

Click the **Data | Edit | Merge** command in the worksheet to open the **Import Data** dialog.

![Import Data Dialog](image)

Specify files to import into the **Surfer** 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, Surfer will remember the setting until the end of the current session. When Surfer 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 list. The following formats are supported:
- ACCDB Microsoft Access .ACCDB
- BLN Golden Software Blanking .BLN
- BNA Atlas Boundary .BNA
- CSV Comma Separated Variables .CSV
- DAT Data .DAT
- DBF Database .DBF
- DXF AutoCAD Drawing Data .DXF
- LAS LiDAR Data .LAS
- MDB Microsoft Access 97-2003 Database .MDB
- SEG-P1 Data Exchange Format .SEG
- P1 Data Exchange Format .SP1
- SLK Sylk Spreadsheet .SLK
- TXT Text Data .TXT
- XLS Excel Spreadsheet .XLS
- XLSX Excel 2007 Spreadsheet .XLSX
- XLSM Excel 2007 Spreadsheet .XLSM

Load Database
Click the Load Database button in the Import Data dialog to open the Data Link Properties dialog and import a database.

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. The Data Import Options dialog can be used to import data from different locales correctly, for example when the data uses ambiguous or different date order or when the data uses different decimal and column delimiters than the local PC.
Insert - Worksheet

The **Data | Edit | Insert** command inserts a single blank cell or a block of blank cells in the worksheet. Select cells in the area in which you wish to insert cells and then click **Data | Edit | Insert**, or right-click and select **Insert** from the context menu. The **Insert** dialog appears. Specify how you want the original displaced contents moved when the blank cells are inserted.

Click the **Data | Edit | Insert** command, or press CTRL+R on the keyboard, to open the **Insert** dialog.

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

Click the **Data | Edit | Delete** command, or press CTRL+D on the keyboard, to open the **Delete** dialog.

When using **Data | Edit | Delete**, you can shift cells to the left or up to fill in the gap.
Shift Cells Left or Shift Cells Up
Click the *Shift Cells Up* or *Shift Cells Left* option to specify if cells will be shifted to the left or 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 DEL key, or use the *Cut* command.

Find
The *Find and Replace* dialog displays when the *Data | Find | Find* or *Data | Find | Replace* commands are selected. The *Find and Replace* dialog is used to locate and replace specific numbers or text in the worksheet.

The *Data | Find | Find Next* command is used to find the next instance of a particular number, word, or phrase in the worksheet. If the *Data | Find | Find* command was not used initially, the *Find and Replace* dialog opens so that you can define your search criteria.

Find Page
Clicking the *Data | Find | Find* command, pressing CTRL+F on the keyboard, or clicking the F3 key on the keyboard opens the *Find* page of the *Find and Replace* dialog.

Find
To find objects, 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.
Chapter 3 - Data Files and the Worksheet

- 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, cd01, 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 (e.g. column B) of the active cell (e.g. cell B2) for the information listed in the Find field.
- Select The row where active cell is to search only the row (e.g. row _2) of the active cell (e.g. 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 column or to the right across rows by selecting By row.

In this example, cell A2 is selected. If the Find criteria is "9", and By column is the search order, cell A4 is found first. If By row is the search order, cell C2 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 Deselect all first box is cleared, 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. 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 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 the **Close** button to exit the **Find and Replace** dialog.

**Find Next**
Clicking the **Data | Find | Find Next** command or pressing the F3 key on the keyboard finds the next instance of a particular number, word, or phrase in the worksheet. Each cell matching the search parameters remains selected. If the **Data | Find | Find** command was not used initially, the **Find and Replace** dialog opens so that you can define your search criteria.

**Replace**
The **Find and Replace** dialog displays when the **Data | Find | Find** or **Data | Find | Replace** commands are selected. The **Find and Replace** dialog is used to search and replace specific numbers or text in the worksheet.

**Replace Page**
Clicking the **Data | Find | Replace** command or pressing CTRL+H on the keyboard 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.
Use the **Find and Replace** dialog to replace numbers or text in the worksheet.

**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 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 has "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 (see *Selecting Worksheet Cells*), and click the *Data* | *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 numeric data display in the worksheet.

**Alignment Page**
Use the **Alignment** page to set the cell alignment.

**Background Page**
Use the **Background** page to set cell background color.

**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 (i.e. a blackslash "). These "numbers" are read as text and not as a number. The Transform command can be used to perform a mathematical function, such as ATOI(X), to convert a text string to an integer value. Alternatively, the cell can be converted to numbers with the Text to Number command.

**Preserving Cell Format**
The only formats that preserve cell-formatting information are Excel or SYLK SLK. ASCII file formats (.CSV, .TXT, .DAT, .BNA, .BLN) do not preserve file format information.

**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 (see Selecting Worksheet Cells), and then click the **Data | Format | Format Cells** command. Use the **Number** page to change the numeric data display in the worksheet. 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 surrounded by quotes) which are read as text and not as a number. The Transform command can be used to perform a mathematical function, such as ATOI(X), to convert a text string to an integer value. Alternatively, the cell can be converted to numbers with the Text to Number command.
Select the number format options on the Number page of the Format Cells dialog.

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 date and/or time. Select Date/Time and then type or select the Date/Time format.

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.

Sample
The Sample box displays the current number format.
Date/Time Format
When the Type is set to Date/Time, the Date/Time format option becomes available. Type the desired format into the Date/Time format field, or click the button to insert a date/time format with the Date/Time Format Builder dialog. Available formats are made of combinations of day, month, year, AD/BC or CE/BCE designation, hours, minutes, seconds, and AM/PM designation. Days are shown as d or dd. Months are shown as M, MM, MMM, MMMM, or MMMMM. Years are shown as yy or yyyy. Hours are shown as h or hh. Minutes are shown as m or mm. Seconds are shown as ss. Sub-seconds are displayed as ss.0 or ss.000. AM/PM designation are shown as tt or TT. BC/AD designation is shown as gg or GG. BCE/CE designation is shown as g, ggg, G, or GGG. Total elapsed time is shown as [h]. After clicking on the Date/Time format, the Sample updates to show a value in the selected 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.

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 (see Selecting Worksheet Cells), and then click the Data | Format | Format Cells command. Use the Alignment page 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.

Select the alignment options on the Alignment page of the Format Cells dialog.
General
*General* aligns text on the left side of the cell and numbers on the right side of the cell.

Left
*Left* aligns text and numbers with the left side of the cell.

Center
*Center* aligns text and numbers with the center of the cell.

Right
*Right* aligns text and numbers with 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 (see *Selecting Worksheet Cells*), and then click the *Data* \* Format \* Format Cells command. You can set cell background color on the *Background* page. Save the worksheet in *Excel* format to save background color in the file.

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.

Column Width
You can change the column width of selected cells by clicking the Data | Format | Column Width command or by using the mouse to resize the column. The Excel XLS 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 either the entire column or individual cells within the columns (see Selecting Worksheet Cells), and then click the Data | Format | Column Width command. Enter the width for the selected column or cells into the Column Width dialog. Columns can range from zero to 512 characters wide. The value zero (0) hides the column.

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 . Press and hold the left mouse button and move the cursor to the left or right to change the width of the column. You can double-click the column line to automatically set the column width. When automatically setting the column width, the column narrows or widens to the smallest size necessary to completely display the data and column name.

Hide a Column with the Mouse
You can hide a column by moving the cursor to the left until the next dividing line is reached.

Display Hidden Columns with the Mouse
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 clicking the Data | Format | Row Height command or by using the mouse to size the row. The Excel XLS 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 the row height or hide rows, select either the entire row or individual cells within the rows (see [Selecting Worksheet Cells](#)), and click the **Data | Format | Row Height** command. Enter the height for the selected row or cells in the **Row Height** dialog. Rows can range from zero to 512 points in height. A value of zero (0) hides the row.

![Row Height dialog](image)

*Change the row height by selecting rows, clicking **Data | Format | Row Height**, 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 and move the cursor up or down to change the height of the row.

**Hide a Row with the Mouse**

You can **hide** a row by moving the cursor up until the next dividing line is reached.

**Display Hidden Row with the Mouse**

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.

**Transform - Worksheet**

Click the **Data | Data | Transform** command to open the **Transform** dialog, where you can apply mathematical transformations to the 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 display a list of predefined mathematical functions. Click the Functions << button again 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); underscore and 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. Click the Insert button to add a function to the Transform equation box. In the Transform equation box, manually change the variable (i.e. X or Y) in the listed functions to a column letter, row number (_1), or cell location.

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 | 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.

Sort - Worksheet

The **Data | Data | Sort** command arranges data according to rank in user-specified sort columns. Sorting rank is based on numbers, ASCII characters, and punctuation. Sort numeric data, text, or mixed columns. Sorting specifications are made in the **Sort** dialog.

Selecting Cells to Sort

Sorting is performed only on the selected columns (see **Selecting Cells**). 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.

Sort Dialog

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

![Sort Dialog](image)

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

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.

Spatial Filter
The Data | Data | Spatial Filter command can be used to spatially filter the X, Y and Z coordinates. This can be useful when pre-filtering data before creating a post map, variogram, or grid file and saving the data for use in other programs in the future. The spatial filter can be used to allow duplicate removal and arbitrary exclusion with a mathematical expression. Spatial filter specifications are made in the Spatial Filter dialog.

Spatial Filter Dialog
Click the Data | Data | Spatial Filter command in the worksheet to open the Spatial Filter dialog.
Specify custom options to spatially filter data in the **Spatial Filter** dialog.

**Input Columns**
The *Input Columns* section indicates the original X, Y and Z columns. Select the *Input Columns* in the X, Y, and Z lists. Click the arrow button to see the list. The Z column is optional and can be set to *None* if the operation is for 2D (X, Y) coordinates only. If the Z *Input Columns* is set to *None*, the Z *Output Columns* is not available.

**Output Columns**
The *Output Columns* section indicates the location where the filtered results of the X, Y and Z columns are written. Select the *Output Columns* in the X, Y, and Z lists. Click the arrow button to see the list. If the Z *Input Columns* is set to *None*, the Z *Output Columns* is not available.

Filtered results are written to the original row and new worksheet columns as specified in the *Output Columns* group. New data are added to the bottom of the worksheet to ensure that the source and target points stay aligned on the same row.

**Duplicate Data**
The *Duplicate Data* section contains methods for defining and handling duplicate data points. Duplicate data are two or more data points having nearly identical X, Y coordinates (Z values may vary for these X, Y coordinates). Select the action for duplicate data in the *To Keep* list. Enter the *X Tolerance* and *Y Tolerance*. If a point is deleted (due to duplication or exclusion), the output cell is left blank.

**To Keep**
Duplicates are determined by moving from the lowest X value to the highest X value. A datum only belongs to one set of duplicates. The *To Keep* options specify which duplicate data points to keep and which to delete in each set of duplicate points. Specify *All*, *None*, *First*, *Last*, *Minimum X*, *Maximum X*, *Median X*, *Minimum Y*, *Maximum Y*, *Median Y*, *Minimum Z*, *Maximum Z*, *Median Z*, *Sum*, *Average*, *Midrange*, or *Random* from the *To Keep* list.

<table>
<thead>
<tr>
<th>option</th>
<th>description</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>Do not delete any duplicates.</td>
</tr>
<tr>
<td>None</td>
<td>Eliminate all of the duplicates.</td>
</tr>
</tbody>
</table>
### To Keep Options

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First</strong></td>
<td>Keep the first point, as defined by the order in the data file, from each set of duplicates.</td>
</tr>
<tr>
<td><strong>Last</strong></td>
<td>Keep the last point, as defined by the order in the data file, from each set of duplicates.</td>
</tr>
<tr>
<td><strong>Minimum X</strong></td>
<td>Keep the point with the minimum X coordinate.</td>
</tr>
<tr>
<td><strong>Maximum X</strong></td>
<td>Keep the point with the maximum X coordinate.</td>
</tr>
<tr>
<td><strong>Median X</strong></td>
<td>Keep the point with the median X coordinate.</td>
</tr>
<tr>
<td><strong>Minimum Y</strong></td>
<td>Keep the point with the minimum Y coordinate.</td>
</tr>
<tr>
<td><strong>Maximum Y</strong></td>
<td>Keep the point with the maximum Y coordinate.</td>
</tr>
<tr>
<td><strong>Median Y</strong></td>
<td>Keep the point with the median Y coordinate.</td>
</tr>
<tr>
<td><strong>Minimum Z</strong></td>
<td>Keep the point with the minimum Z value.</td>
</tr>
<tr>
<td><strong>Maximum Z</strong></td>
<td>Keep the point with the maximum Z value.</td>
</tr>
<tr>
<td><strong>Median Z</strong></td>
<td>Keep the point with the median Z value.</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td>Create an artificial datum at the centroid of the duplicate points with a Z value equal to the sum of the duplicate set's Z values.</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>Create an artificial datum at the centroid of the duplicate points with a Z value equal to the average of the duplicate set's Z values.</td>
</tr>
<tr>
<td><strong>Midrange</strong></td>
<td>Create an artificial datum at the centroid of the duplicate points with a Z value equal to the midrange of the duplicate observations' Z values halfway between the minimum Z and the maximum Z.</td>
</tr>
<tr>
<td><strong>Random</strong></td>
<td>Keep a single randomly selected representative point.</td>
</tr>
</tbody>
</table>

### X and Y Tolerance

In addition to the To Keep options there are X Tolerance and Y Tolerance options. For example, two points, A and B are duplicates if:

\[
|X_A - X_B| < X\text{Tolerance}
\]

and

\[
|Y_A - Y_B| < Y\text{Tolerance}
\]

Using this definition, it is possible for points A and B to be "duplicates," for point B and C to be "duplicates," but for A and C to not be "duplicates."

### Data Exclusion Filter

The Data Exclusion Filter allows a Boolean expression to specify how to exclude data. The Data Exclusion Filter can be used with any column in the worksheet that contains numbers. Columns in the worksheet that contain text or columns that are empty will not be excluded by the Data Exclusion Filter.

To use one of the X, Y, or Z columns, use X, Y, or Z in the Data Exclusion Filter. To use another column from the worksheet, use _A, _B, _C, etc. The underscore is required when specifying a worksheet column.

For example:

```plaintext
To exclude points based on X and Y coordinates:

```

\[
X_A - X_B < X\text{Tolerance}
\]

and

\[
Y_A - Y_B < Y\text{Tolerance}
\]

In the Data Exclusion Filter:

```
(X < X\text{Tolerance})

and

(Y < Y\text{Tolerance})

DataExclusionFilter
```

To exclude points based on a column named `Column1`:

```
DataExclusionFilter(_Column1 < Column1\text{Tolerance})
```
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<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X=-999 or Y=-999 or Z=-999</td>
<td>Excludes any data with a -999 value in either the X, Y, or Z columns.</td>
</tr>
<tr>
<td>X&lt;10 or X&gt;20 or Y&lt;10 or Y&gt;20</td>
<td>Excludes all data except for points in the range 10 to 20 for both the X and Y directions.</td>
</tr>
<tr>
<td>Z &lt; 0.0</td>
<td>Excludes any triplet with Z value less than 0.0.</td>
</tr>
<tr>
<td>_A &gt; 10</td>
<td>Excludes any row in the worksheet that contains a value greater than 10 in column A.</td>
</tr>
<tr>
<td>Z &lt; 0 AND _D = -999</td>
<td>Excludes any triplet with Z value less than 0.0 and whose row in the worksheet contains a value in column D equal to -999.</td>
</tr>
</tbody>
</table>

Boolean expressions, used by Grids | New Grid | Function, Grids | Calculate | Math, Grid | Data, and Grid | Variogram, include:
- logical operators (AND, OR, XOR, NOT)
- comparison operators (=, <>, <, >, <=, >=)
- the IF function - for example 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.

To use a stored function, click the ▼ next to the current function. This will display the ten most recent functions used. The functions are stored in the registry, so the equations are stored between Surfer sessions. You can also start typing the function in the function box. If the function is in the ten function history, the entire function will auto-complete.

For example, consider the case of ignoring data outside of a grid. The original grid X Maximum is 50, but the grid X Maximum is reset to 40. To limit the search to data with X values less than 40, use the Data Exclusion Filter by entering X > 40 into the Data Exclusion Filter text box. This tells Surfer to exclude all data with X values greater than 40.

Consider a second case where data contains a numerical identifier in column D. When the value in this column is equal to -999, the data point is considered inaccurate and should not be used when gridding. To grid only those data where column D is not equal to -999, exclude column D with the Data Exclusion Filter by entering _D = -999 into the Data Exclusion Filter text box. This excludes all rows of data where column D contains the value -999.

Statistics
The Data | Data | Statistics command calculates statistical values for a group of selected numeric cells (see Selecting 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
Use the Data | Data | Statistics command in the worksheet to open the Statistics dialog.
Select Items to Compute

Click in the check boxes next to the statistics options to calculate the statistics for the selected data:

- **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 than 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 (25th 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.
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- **Third quartile (75th 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. 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.

The *Labels in first row* option is also specified in the *Data* group. 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. 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.

Select *Copy to worksheet* to write the statics report to a new location in the worksheet. 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. Click *OK* to overwrite the data, or click *Cancel* to set a new *Starting in cell* location.

### 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*.

- **Use all values**
  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.

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

Use values outside the range

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.

Use all values except

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.

The Use all values except option can be used to ignore NoData values. For example, the NoData value for the Concentration.grd sample grid file is the Surfer default NoData value, 1.70141E+38. Two methods exist for ignoring the NoData 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 Concentration.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 non-NoData values only.

Statistics Results Dialog

The Statistics Results dialog is displayed when the Show in a window option is selected in the Results section of the Statistics dialog.
Click *Copy* to copy the results to the clipboard. The results can be pasted in another program. If you wish to paste the results into a *Surfer* worksheet, close the *Statistics Results* dialog first.

Click *Close* 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% of the time (for the 95% confidence interval) or 99% 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

\[ \pm t_{(n-1), 0.05} \left( \frac{SE}{\sqrt{n}} \right) \]

99% Confidence Interval for the Mean

\[ \pm t_{(n-1), 0.01} \left( \frac{SE}{\sqrt{n}} \right) \]

where
tv, α = the value of the Student’s t distribution with v degrees of freedom such that difference between the cumulative probability function evaluated at tv, α and - tv, α is equal to 1 - α.

SE = the 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)

\[ MD = \frac{1}{n} \sum_{i=1}^{n} |x_i - \bar{x}| \]

Definition of Population Mean (μ)

Definition of Sample Mean (\( \bar{x} \))

where

- N = number of data values for a population
- n = number of data values for a sample
- \( x_i \) = i\textsuperscript{th} data value

Coefficient of Kurtosis

Kurtosis is a measure of how sharp the data peak is. 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)

\[ g_2 = \left\{ \frac{n(n+1)}{(n-1)(n-2)(n-3)} \sum \left( \frac{x_i - \bar{x}}{s} \right)^4 \right\} - \frac{3(n-1)^2}{(n-2)(n-3)} \]
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(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
- \( x_i \) = \( i^{th} \) data value

Coefficient of Skewness
Skew 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 0. 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 (\( g_1 \))
\[
g_1 = \frac{n}{(n-1)(n-2)} \sum \left( \frac{x_i - \bar{x}}{s} \right)^3
\]
where

\[ \sigma = \text{Population Standard Deviation} \]
\[ s = \text{Sample Standard Deviation} \]
\[ \mu = \text{Population Mean} \]
\[ \bar{x} = \text{Sample Mean} \]
\[ N = \text{number of data values for a population} \]
\[ n = \text{number of data values for a sample} \]
\[ x_i = i^{th} \text{ data value} \]

**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 and this measure is only useful when dealing with strictly positive data.

Population Coefficient of Variation (V)

\[ V = \frac{\sigma}{\mu} \]

Sample Coefficient of Variation (V)

\[ \bar{V} = \frac{s}{\bar{x}} \]

where

\[ \sigma = \text{Population Standard Deviation} \]
\[ s = \text{Sample Standard Deviation} \]
\[ \mu = \text{Population Mean} \]
\[ \bar{x} = \text{Sample Mean} \]

**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% 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 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’s necessary to compute the difference between bottom of the step and the normal curve and also 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
- \( x_i \) = \( i^{th} \) 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.

An alternate description: 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
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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
- $x_i$ = $i^{th}$ data value

Statistics References


**Text To Number**
Click the Data | 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 with a ' before the number. For instance, in the image below, the number 40 appears as '40, if the number if formatted as text.

To convert a cell:
1. Click on the cell to select it.

2. Click the Data | Data | Text to Number command.
3. The cell converts to numeric format, if the cell had been a text number. The cell edit box now displays the number without the ' before it.

**Transpose**
The Data | 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 | Data | Transpose command and the columns become rows and the rows become columns.

For example, consider the following data:
Categories A, B, and C are displayed with each category in a row.

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

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Category</td>
<td>Spring</td>
<td>Summer</td>
<td>Fall</td>
<td>Winter</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>12</td>
<td>14</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>3</td>
<td>B</td>
<td>13</td>
<td>5</td>
<td>23</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>C</td>
<td>51</td>
<td>21</td>
<td>12</td>
<td>32</td>
</tr>
</tbody>
</table>

Categories A, B, and C are now displayed with each category in a separate column.

### Assign XYZ Columns - Worksheet

The **Data | Data | Assign XYZ Columns** command allows you to specify the X, Y, and Z columns containing your coordinate data.

The assigned columns are used as the default X, Y, and Z columns for commands that require column input, such as the **Grids | New Grid | Grid Data** and **Home | New Map | Post** commands. The **track cursor** command requires that the X, Y, and Z columns be specified properly in order to display the current coordinates when a point is clicked in another window.

Indicators in the worksheet column headers display the current columns. When the coordinates are changed in the **Assign XYZ Columns** dialog, the X, Y, and Z indicators move to the specified columns. If there is no actual data in the user assigned columns, **Surfer** will assign columns that contain data to the coordinate columns.

Indicators in the worksheet column headers display the X, Y, and Z columns specified in the **Assign XYZ Columns** dialog.
The Assign XYZ Columns Dialog
The **Data | Data | Assign XYZ Columns** command opens the Assign XYZ Columns dialog.

![Assign XYZ Columns Dialog](image)

Use the **Assign XYZ Columns** dialog to specify the worksheet columns where the X, Y, and Z values are located.

**X (Easting) Column**
Select a worksheet column from the **X (Easting) column** list.

**Y (Northing) Column**
Select a worksheet column from the **Y (Northing) column** list.

**Z (Elevation) Column**
Select a worksheet column from the **Z (Elevation) column** list.

Click **OK** to save the assigned X, Y, and Z columns. The X, Y, and Z indicators will move to the assigned columns. Click **Cancel** to cancel the change in the column definitions. The default columns are used.

Assign Coordinate System - Worksheet
The **Data | Coordinate System | Assign Coordinate System** command links a data file to a specific coordinate system. Once the coordinate system is defined for the data file, a **Golden Software Georeference .GSR2** file is created. This file contains all the relevant projection information that **Surfer** needs to load the data in the proper projection.

When a .GRD file is created using the **Grids | New Grid | Grid Data** command, the .GSR2 file for the data is read. The projection information can be saved with the grid file using the **Spatial References** options. It is recommended to check the **GS Reference (Version 2) file** if you intend to use the grid file in **Surfer**, as the GSR2 retains all of the information needed. The grid has the same coordinate system as the original data file, but the .GSR2 is required to define the coordinate system. When a map is created from either the data file or the .GRD file, the .GSR2 file is read and the **map layer** automatically has the correct coordinate system.

New Projected Coordinates - Worksheet
The **Data | Coordinate System | New Projected Coordinates** command specifies a **Source Coordinate System** and projects the X and Y coordinate data to a new **Target Coordinate System**. The input **Source Columns** and output **Target Columns** allow you to either overwrite the original coordinate columns, or write the new coordinates to new columns in the worksheet. For example, this command
can be useful if you have coordinate data in latitude and longitude and need to project the coordinates to UTM.

**New Projected Coordinates Dialog**

The **Data | Coordinate System | New Projected Coordinates** command in the worksheet opens the New Projected Coordinates dialog.

**Source Columns**

Specify the columns containing the X and Y coordinates in the **Source Columns X** and **Y**. Click the arrow to see a list of the data columns in your worksheet. The **Source Columns** contain the X and Y values in the existing coordinate system.

**Source Coordinate System**

Assign the **Source Coordinate System** by clicking the button to open the **Assign Coordinate System** dialog. The **Source Coordinate System** is the system that your X, Y coordinate data are currently using.

**Target Columns**

Specify the X and Y destination columns in the **Target Columns X** and **Y**. The projected output coordinates will be located in the target columns specified. Click the arrow to see a list of the data columns in your worksheet.

**Target Coordinate System**

Assign the **Target Coordinate System** by clicking the button to open the **Assign Coordinate System** dialog. The **Target Coordinate System** is the new coordinate system that you want to use to project your X, Y coordinate data.

**OK and Cancel**

Click **OK** to write the new projected X and Y coordinates to the **Target Columns**. Click **Cancel** to close the **New Projected Coordinates** dialog without making any changes to the worksheet.
DMS to DD
Click the **Data | Coordinate System | DMS to DD** command to convert DMS longitude and latitude values to decimal degrees. The **DMS to DD** command converts two source columns of data and writes the new values in two target columns.

DMS to DD Dialog
The **DMS to DD** dialog is opened when the **DMS to DD** command is clicked. Specify the source and target columns and the source DMS format in the **DMS to DD** dialog.

**Source Columns**
The **Source Columns** group contains the **Longitude** and **Latitude** columns and the **DMS Format**.

**Longitude and Latitude**
Select the column containing DMS longitude values in the **Longitude** field. Select the column containing DMS latitude values in the **Latitude** field. Click the current selection to change the column. The **Longitude** and **Latitude** column lists only include columns with data. The **Latitude** column values must be between -90 and 90 degrees.

**DMS Format**
Select the source data format in the **DMS Format** field. Click the current selection and select the desired format from the list. DMS source data must be formatted in one of the following data formats, and all of the source data must use the same format:

- **DDD MM SS.SSS - DMS separated** - this format includes degrees, minutes, and seconds separated by spaces. Optionally, this format can include symbols and a hemisphere indicator, e.g. 105° 6’ 32.5” W.
- **DDD MM.MM - DM separated** - this format includes degrees and minutes separated by a space. Optionally, this format can include symbols and a hemisphere indicator, e.g. 105° 6.54167’ W.
- **DDMMSS.SSS - DMS packed** - this format includes degrees, minutes, and seconds without any spaces. The minutes and seconds values must include two digits. Optionally, this format can include a hemisphere indicator, e.g. 1050632.5 W.
- **DDMM.MM - DM packed** - this format includes degrees and minutes without any spaces. The minutes value must include two digits. Optionally, this format can include a hemisphere indicator, e.g. 10506.54167 W.
• DD.DDD H - Degrees w/ hemisphere - this format is decimal degrees with a hemisphere indicator, e.g. 105.109 W

Target Columns
The Target Columns group contains the Longitude and Latitude columns. Select the column where the converted longitude values should be created in the Longitude field. Select the column where the converted latitude values should be created in the Latitude field. Click the current selection to change the column. Select the same columns as the Source Columns if you wish to overwrite the source data. The default Longitude and Latitude columns are the first empty columns in the worksheet.

OK and Cancel
Click OK to create the decimal degrees longitude and latitude columns. Click Cancel to close the DMS to DD dialog without converting the values to decimal degrees.